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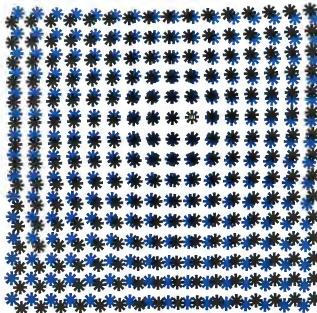
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AVIATION CALENDAR

(Continued from page 5)

- Dallas, Ohio.
May 14-16—**U.S. University of Modern Sciences** Annual Radar Symposium, New York, N.Y.
June 2-8—13th National Maintenance and Operations Meeting, Reading Aviation Service Inc., Reading, Pa.
June 6-8—International Instrumentation Systems Conference & Exhibit, Instrument Society of America, Royal York Hotel, Toronto, Canada.
June 15-19—National Test Meeting, Institute of the Aerospace Sciences and American Rocket Society, Northridge Hotel, Los Angeles, Calif.
June 15-19—17th Meeting Aviation Division and Mechanical Arts Division, Hotel Atlantic City, N. J.
June 16-19—50th Annual Conference, Product Engineering and Production, Institute of Radio Engineers, Sheraton Hotel, Philadelphia, Pa.
June 19-21—Space Flight and Society Symposium, Symposium, International Astronautical Federation, International Academy of Astronautics, Paris, France.
June 21-21—English Annual Symposium on Computers and Data Processing, Data Research Institute, Eddon Lodge, Eddon Park, Colo.
June 26-28—5th National Conference on Military Electronics, Institute of Radio Engineers, Sheraton Hotel, Washington, D. C.
June 26-30—Special Technical Conference, American Institute of Electrical Engineers, Aerospace Transportation Conference, Rosemont Hotel, Rosemont, Ill.
June 28-30—5th Automatic Control Conference, University of Colorado, Boulder.
June 28-30—5th Annual Meeting, Institute of Navigation, Washington Inn, McLean, Va.
July 17-19—Large Contract Vehicle Service Symposium, National Automobile Service Assn., Hotel Washington, Washington, D. C.
July 24-26—Air Traffic Control Conference, Symposium, Electronic Measurement Engineering Assn., Mayflower Hotel, Washington, D. C.
July 28-Aug. 12—International Trade Fair and Exhibition, Edinburgh, McCormick Place Symposium, Chicago, Ill.
Aug. 3-5—1968 Aviation Research Meeting, American Astronautical Society, Sheraton Hotel, New York, N.Y.
Aug. 7-9—Cochran and Associates, Inc., American Society of Mechanical Engineers, Palo Alto, Calif.
Aug. 12-14—Western Electronic Show and Conference, Convention Center, Anaheim, Sept. 4-10—1968 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.
Sept. 8-10—National Symposium on Space Electronics and Telecommunications, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.
Sept. 10-12—National Convention, National Astronautical Assn., Washington, D. C.
Oct. 27-29—1968 International Astronautical Congress, Washington, D. C.
Oct. 9-11—American Society of Mechanical Engineers, 16th Annual Meeting & Space Flight Report to the Nation, Colorado, New York, N. Y.



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An infrared system, however, need not take in the whole observable universe nor even the whole earth to interest Kodak. We also operate in the infrared at lower altitudes of technical sophistication. We even get in on such down-to-earth systems as those that go in little boxes alongside the railroad tracks to watch for hot boxes on freight trains. These do not require such fancy amplifiers as the diffraction homodyne one we built to take a signal from an liquid-helium-cooled copper-coated germanium detector on the 60-inch Perkin Observer's telescope. (It can ramp down to a 601 cycles/sec scanning bandwidth so that in 30 minutes it can distinguish the emission of a single star from intergalactic infrared noise.)

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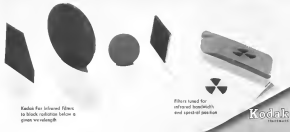


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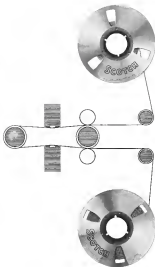
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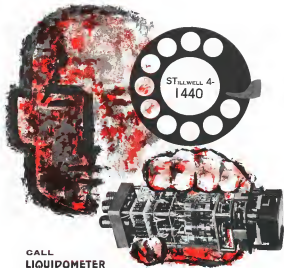
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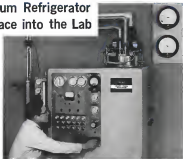
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Mr. McNamara's Misinformation

It is difficult to make sound decisions on the basis of best information. Therefore, it is not surprising that Defense Secretary Robert McNamara has made a somewhat unusual decision in waging out the Aircraft Nuclear Propulsion program, because it was based on inaccurate and/or absolute information spread by a circle of deliberate distortion.

In fairness to Mr. McNamara, it must be noted that in his extremely short tenure as the Pentagon's chief, he has had to have developed expertise on all aspects of his multifaceted job. He must, of course, rely on the validity of information submitted to him by subordinates. It is easily demonstrated that the information submitted to him for his decision on the ANP program was grossly inaccurate, technically out of date and deliberate distortion.

Some may question Mr. McNamara's executive judgment in making such a hasty decision on such a technically and militarily complex subject after such brief exposure to it. We think the case of the ANP program will provide an interesting yardstick in which to measure Mr. McNamara's intellectual integrity and his capacity for penetrating the blizzard of huge information that inevitably surrounds even newly appointed civilian executives in the Pentagon's upper levels.

If Mr. McNamara fails to penetrate this fog, advised to make the effort to get his facts first hand from the responsible technicians, and only conducts a routine bureaucratic defense of his badly reached decision, it will bode ill not only for ANP but for the future defense of this country.

Let us continue for accuracy the public statements of Mr. McNamara as which he may be based his decision to wage out the Aircraft Nuclear Propulsion program.

1. He says that the Joint Chiefs of Staff have delayed repeatedly since 1959 their views on specific nuclear reactors for a nuclear-powered aircraft. This statement, in fact, is true as far as it goes, but it omits the rest of the JCS statement which said that certain military potential of this program appeared so promising that it should be continued as a development effort aimed at early accomplishment of this capability. This latter point does not appear in Mr. McNamara's most recent justification of his decision, leaving the clear impression that the Joint Chiefs have waded three strands of the ANP program. Actually, then, he has a clear catch of specific military applications, both Navy and Air Force, for a nuclear-powered aircraft. But all of these hinge on the successful technical development of a complete nuclear-powered flying vehicle, which Mr. McNamara has now cut off.

2. He says that neither the General Electric direct cycle design nor the Pratt & Whitney indirect cycle appears to permit flight at altitudes as great as 35,000 ft or above maximum speeds. This altitude figure, along with the prospectively quoted Mach 0.8 speed barrier, were never meant to be technical limitations on the nuclear powerplant. They are simply the performance specifications laid down by Herbert York, former Defense

secretary of research and engineering, to be met by the initial nuclear-powered aircraft. Both GE and P&W have actually designed expensive applications of their respective nuclear cycles, and no responsible technician in this field would support Mr. McNamara's performance limitations figures. He can, if he so inclined, catch them from correct engineering.

3. He says that the GE direct cycle engine could deliver thrust products on the atmosphere during take-off, landing and cruise at high altitudes, making it unlikely that the aircraft could operate from actual commercial airfield facilities. The problem of feasible exhaust products from the direct cycle engine can be characterized both through operational procedures (i.e., using conventional jet fuel for landing and takeoff) and by technical solutions already determined feasible (i.e., treatment of the exhaust products before they enter the atmosphere). Even without these methods, however, the former product exhausts from the direct cycle engine were well suited to be so negligible, that more than 30 such aircraft could operate from a single field without creating undue hazards exceeding the Atomic Energy Commission permissible standards.

4. He says that the P&W indirect cycle has 15 ms of tubing, serving neither metal at temperatures up to 2,000°F and over 20,000 psi, nor plastic at that level, would contribute a seven-hour delay. These figures are about 4 yr old and no longer accurate. But the important point is that Mr. McNamara apparently does not understand that both USAF and the commercial airlines are operating B-52 and 707 type aircraft safely even with many miles of tubing carrying fluid of hydrostatic fluid and electricity—a task in any one of which could be and has been handled by the aircraft and its equipment. Actually, the accident at Conestoga the board of tanks in the indirect cycle system has been solved technically, as Mr. McNamara could check determine by talking with the men who have done it.

5. He says that the GE proposed B-57 flying test bed rugged with two nuclear-powered direct cycle engines could not be flown as nuclear power alone, that it is a technical failure in the development program, and that it is simply a stunt. This will shock every engineer and technician who has been even remotely familiar with aircraft powerplant development for the past two decades. But, the statement is accurate because even one of the two nuclear-powered engines proposed would sustain the B-57 in flight at medium altitude and both could certainly fly it with ease. This is simply the point of a flying test bed rig for a new powerplant, as any pilot would recognize the aircraft is completely useless the point that for those being a "stunt," this flying test bed is a total step in the technical development process at any new powerplant and has been a standard technique in jet engine development for 20 yr. We suggest his consultation of the senior Naval engineers and Westinghouse and McDonnell engineers on the first and last time they attempted to make a new jet engine with a new air-

On Aircraft Nuclear Propulsion

frame without prior flying test bed true on the new engine. Like his Pentagon predecessor from Detroit, Charles Wilson, who refused the 1952 proposal for a B-36 test bed for a nuclear powerplant as a "stuntship," Mr. McNamara simply does not understand the technique or significance of a flying test bed in new engine development cycles.

6. He says that cancellation of the ANP program does not mean discontinuance of research on high performance reactor because this work will continue under AEC. Actually, the AEC work, authorized in this area under the Fiscal 1962 budget has an specific authorization toward a small aircraft application. It will operate at a small fraction of the previous program level and will assure the disputes beyond any hope of future necessity of the several thousand engineers and technicians who, until Mr. McNamara's decision, represented the sole U.S. resource in this vital field.

A more detailed analysis of Mr. McNamara's public statements on ANP that is possible in the space would produce even more basic errors of fact and omission. Some of the accurate information now being dispensed as gospel in the basically fallacious context of the Aircraft Nuclear Propulsion program, which Mr. McNamara apparently believes, is 15 yr of wasted effort producing nothing but a billion dollar drain of taxpayers' money. Even a moderate amount of historical study on the subject would destroy this dangerous myth, which is a gross lie on the technical capabilities of the engineers and technicians who worked at the field.

The first five of these past-year years were spent in feasibility studies under the NEPA and Legislation projects. By 1951, both groups of learned gentlemen involved reached the same conclusion: that nuclear propulsion could be successfully used in aircraft and a program toward achieving this goal should be organized.

The technical development of ANP hardware got under way in 1952. For the next eight years, it developed into a classic case of how political and executive mismanagement can frustrate technical progress. Three times in this period the entire ANP program was canceled, and four times it was completely reinitiated and aimed in widely divergent directions. With this sort of bungle management and direction, it would not be surprising if little technical progress resulted.

The last it, however, that despite the incredible variations, false cheering and lack of clearly defined technical goals, the engineers and scientists working in the ANP field made truly remarkable progress—progress which in the past two years when the program achieved the type of technical momentum that usually builds over several decades.

The ANP effort advanced reactor techniques far beyond its previous history and produced developments that will have wide application in many areas outside the aircraft field, such as remote power stations and marine reactors. It solved the basic problems of packaging reactors in small enough units to be employed on aircraft, of adequately shielding aircraft crew and equip-

ment, and of operating the other subsystems required in a flying vehicle in the environment of radiation. It achieved potential engine life of 10,000 hr continuous operation at full power with endurance of from 5,000 to 10,000 hr continuous operation at normal cruising power. And it flattened the existing nuclear power variation curve to a mere 5% from the previous standard of about 30%.

In all the eight years of active work on ANP hardware, the prospects for successfully developing a military useful nuclear powered aircraft were never so favorable as they were just before the decision was made by Mr. McNamara to wash its achievement down the drain.

Perhaps the basic management mistake now requiring development of a vehicle to meet specific military requirements before basic engineering and operational feasibility of a full scale flying system was achieved. As such an advanced industry was reached, additional military requirements were loaded onto the program—enough to make it flounder from the start.

Some of the Pentagon experts who led the ANP program arrived had a philosophy that would have disallowed that the Wright brothers be required to solve the problems of aerospace flight before they should be allowed to launch their machine at Kitty Hawk. None of these people are now publicly visible in the ANP debacle, and it is Mr. McNamara who will take the credit or blame for his decision in the pages of history.

It is interesting to note that none of the Pentagon technical experts who are undoubtedly the source of Mr. McNamara's misinformation were available to testify recently before the Joint Congressional Committee on Atomic Energy when it tried to probe into the ANP cancellation. The underlying writers who were finally sent from the Pentagon to this hearing concerned his congressional listeners only of his incompetence to discuss the subject at issue.

Cancellation of the ANP program will cut far deeper than the immediate effects on the three contractors involved in the two engine programs and the N&J aircraft development. This decision arbitrarily shuts the door on a basic new source of power for aerial vehicles of many types, including some completely unforeseen now, and it falsely pretends to the world that we have failed technically in another field where the Soviet Union is certain to publicly demonstrate its success soon.

But the most tragic aspect of the ANP cancellation is the amount of basically inaccurate and erroneous data on which it was based and the demonstration that there is apparently no opportunity for technical facts to be pumped into the government's highest decision-making levels.

The emphasis now being carried on the timeliness of the ANP program may be the same as that engaged on our bombards as a nation if we fail to develop a better system of technical management in our government that will permit the full potential of our technical and industrial resources to be mobilized to meet the challenge of our times.

—Robert Hints

060—new advance in Space Technology Leadership

The Mervel Aerospace and Space Administration selected Space Technology Laboratories, Inc. to design and construct three Orbiting Geophysical Observatories for scientific experiments to be conducted under direction of the Goddard Space Flight Center. These, the first world's first production line, multi-purpose satellites will bring new scope and economy to America's investigations of the near earth and outer space environment. Each spacecraft in the OGO series will be capable of carrying up to 80 selected scientific experiments in a single flight. This versatility will permit newly reserved experiments to be flown earlier than had been previously possible. Savings will result from NASA's application of standardized module structure, lower power supply, attitude control, telemetry, and instrument systems for all OGO series spacecraft. Selection of STL to carry out the OGO program is new evidence of Space Technology Leadership and exemplifies the continuing growth and diversification of STL. Planned STL expansion creates exceptional opportunity for the engineering, engineering and scientist, both in Southern California and in General Electric Research and requires directed to Dr. R. G. Peters, Manager of Professional Placement and Development, at either location, will receive careful attention.

SPACE TECHNOLOGY LABORATORIES, INC. P.O. BOX 80024, LOS ANGELES 45, CALIFORNIA

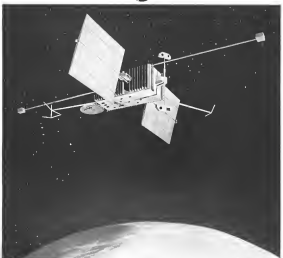
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WHO'S WHERE

In the Front Office

Burt F. Rapp, a director, Rohr Aircraft Corp., Chula Vista, Calif. Mr. Rapp is Rohr's chief executive officer.

Frederick E. Hines, formerly Douglas Aircraft Co., a vice president finance, a director of Electronic Engineering Co. of California, Santa Ana, Calif.

Dr. Allen H. Ross, president of the newly established Electronics Technology Corp., Palo Alto, Calif. Also Dr. William A. Kahan, vice president and director of research, Paul W. Moore, Jr., vice president.

Frederick J. Jordan, president of S. E. Systems Corp., Los Angeles, Calif. succeeded by L. D. Kinnel, vice president.

John E. Hargrave, executive vice president Defense Systems Machines Inc., Los Angeles, Calif.

Richard E. Long, executive vice president Quanticon Inc., Santa Monica, Calif. **Kenneth D. Davis, of General Dynamics, Inc.,** Little Rock, N. Y., has assumed the following appointments: **Robert F. Ward,** group vice president program components; **Joseph B. Bennett,** group vice president systems group; **Thomas J. Thomas,** vice president computer and controls and power equipment.

Dr. Nicholas A. Geyikoff, vice president, Hughes Aircraft Co., Culver City, Calif. Dr. Geyikoff continues as assistant manager ground systems group and device product line operations at Hughes Aircraft.

R. L. Ross, executive vice president, Harbridge Corp., Little Rock, N. Y. Mr. Ross continues as executive vice president and operating head of Harbridge Electronics Division.

Ervin J. Osherson, executive vice president and **Walter J. Hoad,** vice president engineering, Designers Inc., Industry, Calif., Cleveland, Ohio.

The Rando Corp., Detroit, Mich., has elected **Dr. R. D. O'Neal** vice president engineering and **Dr. M. E. Kinnel** vice president government relations to the company's all executive committee.

J. M. Bridgman, vice president and general manager, Little Systems (Canada) Ltd., Redville, Canada.

James D. Kennedy, executive vice president and general manager, Applied Dynamics, Inc., New York, N.Y.

Julius M. Kinnel, executive vice president and a director, Avco Electronics Inc., Los Angeles, Calif.

Simon Nardberg, executive vice president, Avco Corp., Los Angeles, Calif., a subsidiary of Avco Electronics Corp. Also **David J. O'Neil,** general manager of Avco Electronics Corp. East Coast operations, Wallingford, N. Y.

Malcolm C. Scott, head of Space Power Technology Support, Office of Space Flight Programs, National Aeronautics and Space Administration, Washington, D. C. (Continued on page 127)

INDUSTRY OBSERVER

▶ June proposal is being submitted by Space Technology Laboratories, Hughes Aircraft Corp., and General Motors Engineering Corp. to the Federal Bureau of Investigation (FBI) for the development of a new type of vehicle, the "FBI Vehicle." STL would have been the design and integration responsibility. Hughes would design the spacecraft and General Motors would design the mobile vehicle for use on the road's surface.

▶ Navy probably will initiate a design competition for a new generation of anti-submarine warfare aircraft early next year. A number of aircraft configurations, including airplanes, will be evaluated, and previous for integration of ASW equipment will be emphasized.

▶ Research and development is being pushed on retrievable re-entry vehicles carrying payloads for astronomical balloons made application. This would add to the dimension agents introduced in various seasonal flight phase by device and electronic instrumentation.

▶ Army has successfully fired a high altitude target missile called Upstart from White Sands Missile Range. Built by Armco, the vehicle is designed for vertical flight and parachute recovery (NW June 30, 1969, p. 295).

▶ Navy is interested in a television-guided anti-aircraft missile but isn't enthusiastic about Martin Marietta's White Lance TV missile, derived from the Bullseye, because it must be followed relatively close to the target by the launching aircraft. Navy wants a missile that could be launched at a good distance, then directed to the target by the pilot with a visual cockpit display as the aircraft made its escape.

▶ NASA's Goddard Space Flight Center is planning a series of sounding rocket flights under Project Skybolt to serve the northern sky. Four payloads currently are planned for these experiments.

▶ General Dynamics' Electric Boat Division has been selected to study feasibility of designing and building submarine electronics equipment in a single integrated system instead of the present patchwork of systems and components. Raytheon is major subcontractor to General Dynamics in the Navy Bureau of Ships program.

▶ Precision infrared spectra under study at Naval Ordnance Laboratory is planned for automatic operation and tracking of targets at altitudes up to 75,000 ft. Similar precision infrared system is under USAF development.

▶ Lockheed Agave B stage is undergoing static and other test plans in preparation for the launch of National Aeronautics and Space Administration's first Ranger test flight to be launched with an Atlas-Agena in July.

▶ Soviet scientists have shown interest in the idea of using the plasma surrounding a re-entering spacecraft to help decelerate it, a concept also being explored in the U. S. Mervin Thompson of electrically conductive surface experiences a sharp deceleration quickly concluding that exploitable in terms of known aerodynamic drag formula, but if the method is utilizing this speed may remain constant or accelerate when the plasma concentration less pressure, according to Paul G. J. Tokosky.

▶ Construction for the two-view VTOL transporter and Army's light observation helicopter (LOH) program are expected to be shown next week. Lockheed is currently considering going ahead with development of a dual four-place light helicopter based on its LOH entry whether it wins the competition or not.

▶ Project Apollo, three-man spacecraft, now is divided into two phases—Apollo A, an earth-orbiting vehicle; and Apollo B, designed for lunar orbit.

▶ Boeing 737 prototype is being modified by adding a fifth engine position, including intake, at the rear of the fuselage to simulate the center engine in the 737 layout.

New Silicone Rubber Compounds Now Can Be Molded to Closest Tolerances

Looking for durable rubber compounds that offer permanent molding, reliability, and flexibility over a wide temperature range—where other materials have failed?

Here is one example of how silicone rubber compounds come into existence to fill these requirements: through cooperation between Silicons (Dowak) engineers and their customers.

Silicons Engineering Company, Sierra Madre, Calif., had a new emergency oxygen mask under development for passengers on today's high altitude, high-speed jet airplanes. They needed a rubber material with these properties:

1. Resiliency in spring back to shape after heated storage.
2. Softness to conform to facial contours.
3. Extremely low oxygen permeability.
4. Good color dispersion.
5. Non-melting, non-collapse properties.
6. No cracks or tears possible during pressure.

COOPERATIVE ENGINEERING

The Union Carbide Silicons Man brought these and other requirements back to his base of materials as R&D.

Prior to this, the combined technical and research facilities of Union Carbide Corporation, with intensive resources of chemical experience and knowledge,

had already achieved a long list of "firsts" in silicone rubber technology.

A controlled reactivity, vinyl-terminated silicone rubber Auto-curable catalyst system for one-step curing of thick sections. Electrically conductive silicone rubber. A rubber for electrical tapes, lenses, gaskets, and other wrapped constructions. A compound to meet Naval cable specifications for strangle submersibles. And the first and only silicone rubber compound qualified for submarine use pressure seals.



FROM UNION CARBIDE—first overpowered silicone compound for high-altitude emergency oxygen masks.



SILICONS ENGINEERING COMPANY of Sierra Madre, Calif., tests every silicone rubber mask to make sure it meets and exceeds its accurate serial number check to be sure the quality is uniform at all times.

MEETING BASIC PRODUCTION REQUIREMENTS

For Sierra's engine seals, the greatest properties needed had all been met before, but not in a single silicone rubber compound. Working closely with Silicons, engineers of the Boeing Company succeeded in formulating a compound that met the needs and answered all basic production problems as well.

The new compound, patents pending, is extremely close tolerance. Its purity gives flawless flow, mold and form problems during post-cure. It meets the most severe Boeing's strict quality controls, including complete performance test results on every mask produced. And the same compound is now also being used for Sierra's oxygen masks designed for military jet pilots and the crews of commercial planes.

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If you designed calls for rubber with advantages such as low temperature flexibility, thermal and oxidation stability at very high temperatures, low compression set, excellent flame retardance, electrical resistance or conductivity, your Silicons Man has those at his finger tips. The coupon below will bring your problem to his immediate attention.

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Rover Backup

Possibility of a backup program for the Rover nuclear rocket has been raised in Congress and the executive branch of government and sound far more to accelerate the development of space propulsion systems.

House Science and Astronautics Committee, which held five days of public hearings on the Rover program only two months ago, will reopen the whole subject of nuclear power for space vehicles at new hearings expected to be held within two months.

Both industry and government witnesses will be called. At least eight firms—those which had an NRE, the first Rover flight engine (NRE-Ap 10, p. 31)—are expected to testify. The NRE contract is due to be awarded next month.

Several companies will argue for a backup program, using different approaches, on the grounds that the National Aeronautics and Space Administration should not have such a potentially important propulsion system in one pocket.

Committee Chairman O'Brien Brooks told Aviation Week he does not advocate a backup program at this time because the first system is to get sufficient money for Rover. The committee last week added \$23.5 million for Rover to NASA's budget authorization (p. 27). Suggestions for another nuclear rocket project is being considered at high levels in the executive branch as part of the current review of the space program.

John J. McCloy, President Kennedy's disarmament adviser, is busy in present accommodations to the President this week on legislation to establish an area control organization within the government. Meanwhile, the Administration still is working against a July 1 deadline in defining its proposals. This is the date agreed on by the U. S. and the USSR for the completion of disarmament negotiations. In this regard, McCloy's role is including proposals for extended areas that the U. S. might take on control of areas.

Grilling CIA

Central Intelligence Agency's activities are in for at least two serious reviews by the White House and possibly for further congressional scrutiny as a result of its participation in the abortive Cuban invasion and accusations that it encouraged the short-lived revolt of French generals against President Charles de Gaulle.

Dr. James R. Killen, Jr., chairman of Massachusetts Institute of Technology and the new, often former President Eisenhower chose as the first presidential science adviser shortly after Sputnik I was launched, has been asked by President Kennedy to lead a cross-section board of consultants on foreign intelligence activities. His duties are continuing and are separate from the usual limited study of past military operations headed by Gen. G. M. Merrill (p. 28).

Others on the board are Gen. Taylor, former USAF 14; Gen. James H. Doolittle, chairman of Special Intelligence Laboratories; Dr. William O. Baker, now president of research at Bell Telephone Labs, former Under Secretary at State; Robert D. Maughan, now president of Coming Gas International; and Dr. William L. Langer, Harvard history professor. The board is to report periodically on CIA and other intelligence agencies.

Senate Democratic Whip Hubert Humphrey says Congress probably will have to review CIA's activities through a joint working committee to administrative review some changes. There is strong congressional interest in getting CIA out of the "black" intelligence, or operating field.

KLM Route Attacked

Compounded silence on President Kennedy's decision to give KLM, the Dutch airline, a route to Los Angeles, was broken by an unusually strong attack from the President's close friend, Sen. George Smathers. The Florida Democrat denounced State Department's handling of bilateral agreements with foreign nations and was particularly critical of the methods used by The Netherlands—namely, the Dutch ambassador with State Department officials and personal talks between the Dutch foreign minister and the President.

Sen. Smathers warned that approval of the KLM route seems to indicate that the U. S. will yield to "any high pressure campaign" for the awarding of routes and that other foreign governments will adopt the same approach if the KLM decision stands.

Proposed tax on jet lock-ups appears to have a better chance of passage this year than at any time in the past. At various times since jet fuel and jet regular aviation gas, which is taxed, the tax has been dropped and manufacturers against those who are unable to get necessary route approval.

Richard S. Morse is replacing as Army military secretary for research and development. Seniors had not been finally decided upon late last week. —Washington Staff

Air Force, Navy Report Progress In Contract Overcharge Recovery

Washington—Air Force and Navy have reported initial progress in the House Armed Services Investigating Subcommittee in recovering contract overcharges alleged by General Accounting Office.

Recovery by the two services has totaled over \$19.2 million since June, 1959, when GAO allegations of overpricing, particularly on incentive type contracts, were first made in congressional hearings.

The strategy of recovery was not specified—whether USAF or Navy used resources as a contractor, such as Joint Department action—or whether a contractor made a voluntary refund over the overpricing was called to its attention.

The GAO testimony of two years ago was used by Rep. Carl Albert (D. Ga.), chairman of the parent Armed Services Committee, in his continued fight for extension of the investigation law with out amendment.

Preventive Measures

In addition to reporting on past overcharges, USAF and Navy's report called to the subcommittee headed by Rep. Edward Hecht (D.-La.), steps that have been taken to preclude misstatements in the future. These include:

- **Extensive specialized training** of procurement personnel. Service agencies are required to pass special courses prior to the completion of courses. The training of civilians has been increased.
- **Inclusion of a requirement** for accurate pricing in contracts. Contracting General Joseph Campbell agreed with subcommittee members that a status, review, accuracy program "might" be more important agency contribution.

• **"Increased audit reviews"** of contract proposals by USAF officials that cost proposals by industry were not anticipated downward by \$520 million during the January-October, 1960, period in a total of audits. The office in Air Force's Analysis General received \$11.7 billion in passive contract cost proposals in a dollar and 56.1 billion in subcontracts and proposals during Fiscal 1960. In April 8, 1960, assistant secretary of the Air Force for material, pointed out. This represented over \$750 million in Air Force contract proposals and \$2.1 billion in subcontracts proposals during Fiscal 1960, he said.

The sources defended the contractor sub-chargeback incentive type contract as widely used in industry and suggested government, maintaining that tight control of overpricing was among the co-

tributors of realistic "target" prices. No objection to this position was raised by subcommittee members.

At the June, 1959, hearings, GAO alleged excessive pricing of \$39.2 million on contracts it had investigated and reported that this would result in an excess cost to the government of over \$15.6 million. \$6.1 million on Air Force and \$9.5 million on Navy contracts. Results of actions taken by the services are cited as follows:

- **Air Force** recovered a total of \$7 million—more than the \$6.5 million identified by GAO as overcharge. The major recovery was, McDonnell Aircraft Corp., \$1.5 million, Boeing Aircraft Corp., \$1.1 million, Lockheed Aircraft Corp., \$1.4 million, Avco Corp., \$1.1 million.

• **Navy** recovered \$4.6 million, and replenishes the recovery of an additional \$6.5 million through action by the Joint Department. This would make a total recovery of \$9.1 million, compared with the \$9.1 million estimated by GAO. The major Navy recovery is McDonnell Aircraft and General Motors Corp., \$1.2 million.

The two cost Navy has referred to Joint Department—one involving \$4.4 million and the other \$68,200—are not identified in line with Joint Department.

Space Tube Program

San Francisco—National program to design and coordinate applied research on important tubes which are needed for deep space probe tracking and communications, detection and warning of K2000 satellites, and the various weapons have been approved by the Department of Defense.

The national program, directed by an interagency steering committee, is supported by industry, and is expected to be completed by the end of the year, according to James Hedges, director of electronic Office of the Director of Defense.

Hedges says while before the other major research satellite has not been, and that the first separate of both handling defense approach to the problem of high precision geometry are being sponsored by the Advanced Research Projects Agency, Navy, Air Force, and the other.

A recent contract, signed with Lockheed Laboratories indicated that the program would include the recovery high power at X-band, Hedges said.

sent policy on cost under investigation.

Since the mid-1959 hearings, GAO has alleged overpricing on USAF and Navy contracts totaling \$53.7 million and reported that this has resulted in overcharges of \$13.3 million.

No objection to this position was raised by subcommittee members. The Air Force has recovered a total \$7.6 million out of \$13.7 million identified by GAO as overcharges on its contracts. The major recovery was General Electric Co., \$3.7 million, Continental Airlines and Engineering Corp., \$3.0 million, Thompson Radio Works, \$1.0 million, and Northern Radio Co., \$1.0 million.

The largest amount identified by GAO as overcharges which have not yet been recovered are: General Division of General Dynamics Corp., \$2.4 million, Allison Division of General Motors, \$1.5 million, Fairchild Engine and Aircraft Corp., \$1.1 million.

Weather System Effort Management Is Split

Program to develop a non-mission oriented (N5-L) for collecting, analyzing and disseminating weather data, jointly sponsored by the Air Force, Federal Aviation Agency and the Weather Bureau, has split into two complementary efforts.

FAA will take over management of that portion of the original program intended to provide service for civil and military aircraft operating in the U. S. while the Air Force will retain responsibility for the portion required for military operations outside the U. S. (AW Staff 24, p. 13). The FAA reports that about 75% of the original program effort.

United Aircraft Corp., original USAF prime contractor for the AT-1, weather system (AW Staff 28, 1959, p. 70), now has been awarded separate contracts by Air Force and FAA. Under the FAA contract, UAC's Weather System Center will perform system engineering, but FAA's Bureau of Research and Development will retain program direction, including the selection of major subcontractors.

Under the Air Force contract, UAC will serve as program contractor for the USAF AT-1. UAC is engaged in improving and enhancing weather forecasting and observation techniques to meet special military requirements around the globe.

UAC will develop and maintain its present weather system at Mountain Field and Westport AFB, both in Massachusetts, and at McGuire AFB, N. J. Advanced techniques and equipment will be evaluated there starting later this year. The system is a combined and global weather system for use by high-altitude, high-speed aircraft.

Explorer XI Relays Cosmic Ray Study Data

Cape Canaveral—Explorer XI gamma ray atmospheric satellite was launched into an orbital orbit with 1,115-mi. apogee and a 101-mi. perigee, and is scheduled to relay data designed to be used in determining the source of cosmic rays.

The \$2.6 Explorer XI was launched into its elliptical orbit Aug. 27 using a Juno II vehicle in an effort to make the first measurements of gamma rays unobscured by the effects of the earth's atmosphere (AW Staff 1, p. 17). Complete orbital payload, weight 945 lbs., including the spent 1400-lb. fourth stage, orbital rate, which allows it to relay and store in an extension for its telemetric system.

The satellite is in a controlled 10 rpm tumble in its two axis in vacuum.

Scientists here and they hope to obtain usable data for a year to study these opening effects on the origin of cosmic rays.

• **Surface emission**, in which cosmic rays are produced at the surface of stars and the gas.

• **Supernova emission**, which holds that cosmic rays are caused by the shock of hot gas emitted by an exploding star. The Crab Nebula is being studied by the satellite.

Also to be studied are theories on the history of the universe, both expanding and steady state concepts. Basis of the theory of expansion is that the universe was created by a personal explosion.

Steady state theory is based on continuous creation of matter which would be found to radiate energy in the form of cosmic rays.

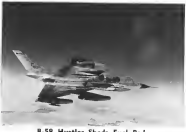
The experimental package (AW Staff 8, p. 26) is powered by 12 nickel cadmium batteries charged by banks of solar cells. The telescope consists of a window to create which emit a electron and positive when struck by gamma rays. The impingement of the rays is relayed to the earth by a frequency of 107.97 mc. Telemetry transmitter operates at 100.00 mc.

Explorer XI is being tracked by its own of the Marshall, AFB, and data are being relayed by the Nimbus Atmosphere and Space Administration's Goddard Space Flight Center.

Planned orbit was 700,000 mi., with a 90-day period. The actual period was 108.65 min.

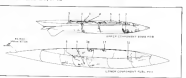
Equipment was prepared by Dr. Willem Krauss and Dr. George Clark of Massachusetts Institute of Technology.

Project scientist is Dr. James Knepper of Goddard, and Dr. Nancy Kessner is headquarters program check.



B-58 Hustler Sheds Fuel Pod

Fuel container is jettisoned from B-58 in supersonic flight in last photo of pod drop (top). Streamlined pod at alt and remains attached to aircraft until fuel container runs down (middle). Second photo shows B-58 with only small amount pod remaining (AW Staff 5, p. 30). Pod drop tests are being conducted by Convair and Air Force units which are based at Keesler AFB, N. M.



Needed members of B-58 two component pod are: 1—Gas generator for back release attitude; 2—Shaped charge ring; 3—Explosive disconnector; 4—Control-actuated control; 5—Forward fuel container; 6—Heated disconnector; 7—Fuel B-58 release; 8—Fuel tank; 9—Heated disconnector; 10—Gas generator; 11—Forward release.

Joint Satellite System Gaining Support

By Philip J. Kline

Washington industry talks on commercial communications satellites. Held last week with the Federal Communications Commission, indicate a tailoring of approaches to American Telephone & Telegraph Company's latest plan for a privately owned space system, providing regulations and safeguards are adequate.

A potential competitor to AT&T and Lockheed entered the picture last week, however, with the announcement by General Electric that it has formed a new subsidiary, Communications Satellite Inc. Purpose of the new company is to "act as a focal point for corporate participation by private enterprise in a worldwide commercial communications satellite system under government regulation."

The new company promptly filed a formal application with the FCC for authorization to establish a commercial communications satellite system, asking it the first to formally request such authority.

Earlier, AT&T and International Telephone & Telegraph Co. requested and received FCC authorization for experimental communications satellite program.

Communications Satellite, Inc. is intended to serve as a nucleus for the formation of a "consensus carrier" company similar to that which was proposed earlier by Lockheed (AW May 20 p. 28).

GE Approach

Under the arrangement proposed by GE, no company or agency, including GE itself, would own more than 10% of the stock in the company, although for the nearest Communications Satellite is wholly owned by GE. This is intended to attract and reassure smaller international communications companies, which are apprehensive about pro-

tection of their interests in a space communications system dominated by AT&T.

Lockheed also has indicated willingness to accept minority ownership in its proposed system or even to bow out entirely.

Revisiting this question, AT&T in its May 21 letter to the FCC and in its reply to the current inquiry (AW Apr. 30, p. 34) is offered to share in ownership of the system it proposed. Further, it then stated a policy of satellite affiliation intended to reassure smaller firms.

Participation would be limited at the U.S. end to international communications links subject to regulations of the FCC. The satellite system could be used by them in rendering any national communications service which they may see or in the future may become authorized by the government to provide. Access to the satellite system would thus be assured on non-discriminatory basis approved and approved to the commission, AT&T said.

RCA Interpretation

Radiation Corporation of America and its subsidiary, RCA Communications, Inc., said in their reply to the FCC, again, that they understood the statement to mean that AT&T "would not restrict the use of its proposed satellite system by other international carriers for any service which the communications authorities deem to be providing voice transmission."

If this understanding is correct, AT&T's position on principles applicable to the use of a proposed satellite system appears to be similar to our position, RCA said.

This reference to voice communications is a crucial test of AT&T's intent, since it now has previously a monopoly on international voice communications. If RCA, or another carrier, should request and be granted FCC authority to compete with AT&T in the field of international voice communications, RCA would guarantee that such channels would be made available in a communications satellite system even if the system should be largely owned by AT&T.

Under the AT&T plan, U.S. international carriers and foreign communications agencies would be allowed to meet in the out of the satellites themselves in preparation to their subsequent use of the satellites, with subsequent adjustments in respect for any differences between actual and anticipated use.

On a case could base facilities at

the satellite system without capital investment.

On this basis, AT&T would be the largest and dominant participant in system ownership.

Ground stations in the U.S. used with the satellites could be jointly owned by the U.S. international carriers on a similar investment sharing basis or carriers could establish their own stations.

Still another possibility for smaller carriers would be to lease the services of jointly owned terrestrial facilities, according to AT&T.

Ground Station Management

RCA said it would want to own, operate and maintain its own ground transmitting and receiving stations for use with communications satellites and that this should be a fundamental principle for any space communications system that FCC authorizes.

RCA, which together with General Telephone & Electronics has held discussions with Lockheed on the technical and management problems of a space communications system, told the FCC that it has "not as yet determined our interest in the common carrier's carrier approach." However, it adds that "could indicate such a joint venture would not be commercially feasible."

Space System Timetable

Three companies expressing a desire to implement a commercial communications satellite system disclosed the following tentative timetables:

- American Telephone & Telegraph Co. Full-scale commercial system, including low-orbiting polar orbits, could be in operation within 3 to 4 years. Company may also deliver the first of several as proposed satellites by December, providing permission is promptly obtained to use launching facilities (AW Apr. 17, p. 184).

- General Electric. First five satellites of a 10-satellite, 0.030 to 0.040 GHz spectrum (plus additional) system could be operational by mid-1976, with the complete system completed by mid-1980.
- Lockheed. System, consisting of a pair of low-orbiting (22,000 mi.) satellites in equatorial orbit over the Atlantic plus another pair over the Pacific, could be achieved within a 1.5 to 2 year period, although the system could not be able to launch in use until the late 1960s or early 1970s. If a decision were made to proceed full speed because of national priority, "U.S. government subsidies might be required during these early years," Lockheed says.



Electronics for the Fleet's Fastest

Collins has served Naval Aviation for more than twenty years. Typical of this service are the Collins communication-navigation-identification (CNI) systems aboard all the Fleet's newest jet aircraft, including those illustrated.



From left: Douglas A-1H, North American A-1H, McDonnell F-4H

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NAVY



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OTHER DIVISIONS: KATRONIC, CHICAGO AERIAL SURVEY, FIDELITY FILM, RITE-A-PACIFIC OPTICAL, QDP—Highland, Calif.

March 3-Plus Interceptor

New York-Moscow interceptors are said capable of March 3 and later were predicted for the 1973-80 era by Neil E. Fawcett, present manager of General Electric's Night Propulsion Division at the 21st annual meeting here of the Association of Defense Writers.

Moscow leaders that will do as much as 2,000 mph. capability of the North American B-70, and superior legions assault, also were predicted for the same period by Fawcett.

by private intercept without AT&T's voice traffic.

RCA does not strongly object to an AT&T-dominated communications satellite system, providing network users are assured of direct access to real-time information, use of the satellites on non-military terms and satellite stations imposed by the owner. But it cautions that ownership or control by a single company could mean that the technology of satellite communications might become proprietary of the technology of a single company.

Electronic II (EII) comments to the FCC the company indicates that it favors the use of communications satellites in a non-military capacity. It adds that the system should be designed to provide maximum service with the minimum number of satellites to keep space in free use possible of other satellite orbits. AT&T favors the use of more low-orbit satellites in medium polar orbits, at least initially.

International Telephone & Telegraph Company and an international communications subsidiary, American Cable and Radio, organized strong support of a space communication system which would be owned and operated by international telecommunications companies.

"It is our view that developing reconnaissance and operations of satellite communications systems should be exclusively in the hands of companies having an undoubted interest and responsibility in the operation of international telecommunications systems," the ITT affiliate told FCC. "There is little hope of having one element of the system (ground facilities) controlled by one company and the other by another company."

The current ITT criticism, coupled with other company statements indicates that the company supports the plan proposed by AT&T.

General Telephone & Electronics told the FCC it opposes both the concept of a communications satellite system owned by a single large company, such as AT&T, and the plan of companies outside the telecommunications field to participate directly in owner-

ship of the space system. "There appears to be no reason for excluding ownership participation by other than common carrier companies if that group alone can make adequate capital, it appears to be the case," GT&E told the commission.

As the matter of the two major U.S. domestic communications companies, GT&E called for assurance against discrimination in the use of the system by competing companies. "Operating rules and regulations and early allocation of devices in an expanded should insure that all message traffic of the same class will be handled on a 'best-effort' basis," GT&E said.

AT&T said in its comments to the commission that the FCC has the authority to impose on its licensees a requirement of non-discrimination as to the system. The company took a step of comment that satellite communication companies such as Lockheed and GE, pointing out that "operation concerning the extent of the commission's jurisdiction over participants who were not themselves international carriers... was not permitted by the plan we propose."

The opposition of the communications companies to having "interference" arising from their field is just one of a number of concerns. The company's "lack of understanding of the design, operation and service problems involved in an space system, according to an official of one international systems company. It demonstrates why a partnership between communications and aerospace companies is needed, he says.

The fact that GE is willing to host an example, in its own field in 1977, and that Lockheed has told FCC that it desires to invest in everything else to the extent needed to advance the project, reflects the basic reality of the two firms—building, launching and operating the satellite.

Lockheed told the FCC that it is prepared to build satellite launch systems, it intends to compete both for the manufacture of the satellite vehicle and for the sale of space system management.

In response to FCC's request for information on whether the commission has the authority to authorize the plan, the company might propose the general question not that the commission does.

General Electric, however, over recent contract difficulties with the Justice Department, says that FCC has the power to seek an opinion from the Attorney General on the propriety of GE raising with other companies, some of them competitors in other fields, to develop details of the space communications system under which it has proposed.

News Digest

An F-4 Phantom jet that crashed during a test on a military base in a F-4 fighter was responsible for the crash of a B-57 bomber which shot down a B-57 bomber on the fighter made a post-crash firing run (AW Apr. 17, p. 10).

Boring Airplane Co. has now dropped the word "Airplane" from its name. "New name is The Boring Company. Stockholders at the annual meeting were told Boring first quarter earnings were \$5,918,825 on sales of \$125,701,841.

American Bosch Arms Corp., which manufactures tactical guidance systems for the Atlas ICBM, is seeking to acquire a semiconductor component company so that it can effectively satisfy the bulk of its large requirements for these semiconductor components. Arms is known to be interested in Silicon Semiconductor Corp. although the latter's management insists the company is not for sale.

Manitowick Industries, Inc. of Manitowish, Wis., has acquired American Development Co. of Manitowish, Wis. American Development Co. will continue as a Manitowick subsidiary, supplying soundproofing and space probe vehicles. Manitowick Industries Inc. is negotiating for acquisition, by its purchase of the subsidiary of Bost's 90% stock, ownership in the subsidiary.

Edward L. Kitchener, Jr., has been appointed deputy assistant secretary of defense (personnel) with responsibility for education and manpower. He previously was associated with the Air Force Electronics Directorate.

Carl F. W. Ragsdale, Galt's, has decided to discontinue development of its three-axis Kalman I, Germany's first post-war helicopter, following financial difficulties which resulted in the firm's reorganization which this year (AW Apr. 1, p. 12).

West German Defense Minister Gensler reports that Defense Minister Galt's, Munich, is developing a government-sponsored two-axis VTOL, without transport, the Do-33. Chance of two Bristol Helicopters 18-33 on the basis of a joint project which is only in the drawing board stage, is being considered.

F. E. N. St. Louis, executive director of the Raytheon Aircraft Co., Ltd., has retired from the company's board of directors.

AIR TRANSPORT

U.S. Plans to Rewrite Export-Import Pacts

Increased foreign aviation sales expected; quality control to be stressed in new agreements.

By David H. Hoffman

Washington—Department of State, anticipating more vigorous international attempts to penetrate the U. S. aviation market, plans to renegotiate a majority—and perhaps all—of the agreements under which the U. S. sells (or leases) foreign certificates of aircraft and engines.

Acting on the advice of the Federal Aviation Agency, the State Department is expected to stress quality control measures in the forthcoming negotiations. It does not plan to move on new certificates designed only to shield the U. S. aircraft industry from foreign competitors.

The major reason for rewriting the so-called export-import bilateral sales of which date back to the late 1920s, is to define precisely such concepts as air vehicle or engine or aircraft, by such agreement. But should State Department and FAA shortly such lack of mutually recognized components, even if all effort is left to discourage foreign exports to the U. S. regardless of U. S. intentions.

FAA officials in the Bureau of Flight Standards do not yet agree on the exact form their recommendations should take. But after examining the bilateral question by more than a year, senior agency spokesmen are predicting that formal recommendations will be forwarded to State Department "within the next few months."

Reciprocal Agreements on the Mutual Recognition of Aerworthiness Certificates are now in effect between the U. S. and 14 nations: Australia, Austria, Canada, Denmark, France, Great Britain, the Netherlands, Norway, Sweden, Union of South Africa, United Kingdom and West Germany.

A fifth agreement is being negotiated with Switzerland, where U. S. airlines are permitted to fly to Geneva, Zurich, Grenchen, Basel, and Lugano. Swiss law has banned the Swiss American Aviation Co. to build the SANC 21—a two-seat, light passenger executive aircraft (AW No. 3-75) 1971. Other air sales with expanding aircraft manufacturing industries—Japan, Mexico and Israel, for example—are expected to make similar contracts this year.

U. S. industries imported \$68.5 million worth of foreign aircraft, engines and spare parts in 1955 when the total value of such imports reached a post war high. Their total value rose \$21.8 million in 1954, \$52.1 million in 1955, \$52.4 million in 1957, \$73.4 million in 1958, \$80.1 million in 1959 and \$82.3 million in 1960.

U. S. air manufacturers of aircraft

and aircraft accessories shift their emphasis toward projects associated with civil aviation. State officials believe that foreign airlines will take a fresh look at the U. S. market for light transport and executive aircraft. There are also indications that foreign manufacturers will seek licensing rights to build replacement parts for the big fleet of aging piston transports still operated by U. S. corporations and airlines.

The U. S. bilateral with the United Kingdom which took effect in October, 1951 covers only "aircraft" and has never been amended. Through a process of mutual interpretation, however, the agreement has been broadened to include engines, propellers and major components.

It is bilateral with Australia, which took effect in November, 1959, a more

what state press, but still fails to include an inclusion of components in its title. As used herein, the term aircraft shall include air craft, aircraft engines and propellers which have been imported in accordance with the agreement.

Protections for the approval of the bilateral agreements previously are left to the "direct regulation" of the appropriate national authorities. However, the United Kingdom National and several others go beyond this by stipulating that the two nations shall "exchange details of the performance of the aircraft in its official flight test and performance of the normal engine speed in flight both the aircraft itself and the particular aircraft and of the normal engine consumption of petrol and oil, and engine power when such applicable."

The two nations also agreed in 1954 to "invest one another" the fullest opportunities to examine mutual standards as to materials, structural conditions and methods, etc., test down and related."

This latter provision underscores the traditional U. S. approach to such agreements—that they be strictly bilateral. FAA refuses that no amount of field inspection can be substituted for standardized manufacturing techniques and the absence of quality control in the factory. In rewriting the European view that a common aerworthiness code can form the basis for such bilateral recognition of export-import agreements, FAA maintains that:

• **State nations with substantial capabilities** nevertheless lack governmental agencies with sufficient laws and regulations to ensure all their aircraft projects meet U. S. standards of reliability. For this reason it may be desirable to apply the principle of mutual recognition selectively to selected, well-developed engines and components in one bilateral and only specified components in another.

• **American flight to the International Civil Aviation Organization (ICAO)** represents the most widely accepted international document on aerworthiness, as far as engine in service as a standard. To avoid American flight a restriction of the ICAO membership is requested.

To establish whether a nation seeking a bilateral with the U. S. will export high-quality products only, FAA is formally asking its counterpart agencies within the foreign government. If that agency is unable to furnish FAA criteria, a bilateral recommendation is sent to the State Department.

TWA Orders 30 Turboprop Transports

New York—Trans World Airlines (TWA) has ordered 30 turboprop transports as part of a 30 plane jet order which TWA will not get the last four General Electric 600s as a Boeing 737 Co. order for 10 aircraft. TWA's ordered 20 of the 30s on the second order and Boeing released six of the aircraft to Northwest.

Reversing the 3200 engine order placed with Boeing, TWA President Charles G. Tinker told it, and that the purchased aircraft will consist of 20 Pratt & Whitney JT8D-1 turbojets and six 4000 hp turboprops.

All the aircraft will be powered by 15,000 hp Pratt & Whitney JT8D-1 turbojets engines. The order will purchase an additional 10 engines in spare. TWA receives other 5000 hp jet on order of 40 four-engine jet aircraft.

TWA will order 5000 hp of its own brand for the new 737s. It will leave the rest for other airlines. The first purchase will bring the aircraft's total order to 30 aircraft on order to be delivered in 1960.

In addition to the Pratt & Whitney JT8D-1 turbojets and Pratt & Whitney JT8D-1 turbojets, TWA is buying power to the Bank of America, also is expected to participate.

The 20 aircraft TWA is purchasing will be delivered in the fall of 1960. The first 10 aircraft will be delivered in the fall of September.

Charles, at a bond meeting in Kansas City, Ernest B. Smith was elected chairman of the board of Trans World Airlines. He succeeds Warren Lee Phipps, who announced his retirement after 14 years in chairman and 15 years as a member of the board. Phipps continues, however, as chairman of the executive committee and a TWA board member.

Blanket Exemption Is Offered for Charters

Washington—Changes in Civil Aeronautics Board's economic regulations permitting international and foreign carriers to apply for blanket blanket exemptions for transatlantic charters, kept into effect late last month.

The Board also has issued a new rule on proposed changes in Part 212 of the Economic Regulations to allow foreign air carriers to conduct off-peak charters under similar blanket exemption.

CAB is attempting to cut paper work with the U. S. carriers and give them more flexibility.

Before Part 205 of the economic regulations was changed, a supplier needed an all-year charter to get prior Board approval for each charter flight. Under the new provision, there comes of their applications for blanket exemption an approval—less, as in many instances, than a charter approval. The 1958 law blanket exemption is issued and does not extend beyond Sept. 15 of next year.

The current rule will allow 15 days after the end of every month, information regarding such charters, including the date of trip, month, aircraft, number of round-trip and one-way passengers, name of chartering organization and keep the accounting that it is a bona fide charter group, and issue for the final flight.

If adopted, the proposed change on charter exemption would permit off-peak charter operations in the U. S. as

the house owner or one of its passengers as long as the trip was one of the seasonal periods. The exemption would be granted in excess 10% of its total scheduled annual revenue plan, with each charter business. As with U. S. suppliers, foreign carriers, specific information is given. The charters would have to be scheduled within 15 days after the close of each month.

Airline Unions Sued By Southern, Western

Washington—Dunwoody, Inc., holding 50 million has filed against two airline unions in Southern Airlines and Western Air Lines.

Southern is losing \$3.1 million in general damages and \$5.5 million in punitive damages from the Air Line Pilots' Ass'n. Southern says the union has used a series of lies and dishonest statements against the company during the course of the strike which began last Jan. 5.

A petition filed by the airline in the Fulton County Superior Court in Atlanta, Ga. contends that ALPA made the statements in handbills, bulletins and letters to employees and stockholders in the strike. Regarding a press release regarding the petition, the plaintiffs' attorneys said that such was the case, the airline charged ALPA's actions constituted an attempt to destroy the goodwill and integrity of the company.

Western filed its suit against the Flight Engineers International Ass'n and 123 engineers who participated in a nationwide walkout in February.

National Grounded By Machinist Strike

Washington—Labor Secretary Arthur Goldberg issued quickly last week to settle a strike of National Airlines (NAA) ground crew to take a complete shutdown of the carrier's service.

NAA's ground crew and flight attendants 4,600 employees. NAA after a strike of 1,100 ground crew employees, called by the International Ass'n of Machinists because of a contract renewal dispute.

NAA mainline was scheduled to take late last week on accepting government authorization, which was proposed by Goldberg and accepted by the union.

The arbitration would be conducted by Nathan F. Rosenberg, who earlier was named to head a group in investigating flight engineer complaints which led to a major U. S. airline strike in February.

Goldberg suggested a meeting between airline and union representatives the day after strike began and the group met last Tuesday. After accepting the arbitration proposal, the next day, the union agreed to return to work.

Wages are a major issue in the dispute, with NAA wanting an hourly wage of \$17 to \$21 rates over a two-year period. A company offer, which would have been \$15.50 an hour, was rejected by the union, which said the increase was not in line with rates recently awarded IAM members on other major airlines.

Wing Problem Blamed In Electra Accident

Washington—Civil Aeronautics Board found last week that the probable cause of the crash of a Northwest Airlines Lockheed Electra near Canton, Ind., on Nov. 17, 1960, was separation of the right wing in flight due to fatigue cracking in overhead fuselage structure.

In its conclusion, the Board found that although there are indications that the aircraft was not in the line of the crash, the Board found that the aircraft was not in the line of the crash, the Board found that the aircraft was not in the line of the crash, the Board found that the aircraft was not in the line of the crash.

CAB concluded that there probably was no significant wing damage in the wing, or in the wing and overhead structure, which made the effects of turbulence more critical than with a damaged wing. It reported that a landing at Chicago on the day of the accident "may well have caused damage to the wing structure."

Eastern Shuttle Service Taps New Market

By Gloria Gardina

New York-Eastern Air Lines has tied up an appreciable fleet of piston planes and crews in its unique Boston-New York-Washington shuttle service, which it hopes will tap a significant new air travel market.

The low-key, no-frills operation began (AW May 14, p. 42) last week with weekday flights every two hours from each point between 5 a.m. and 10 p.m., and weekend flights on a less frequent schedule. The shuttle differs heavily from other commuter-type plans in that no seats were reserved in the 45-passenger 1049C and 1049G Constellation which make up the fleet. The airplanes usually stand by at flight time for loads to be scheduled. A boarding pass issued at the airport shuttle before departure is the passenger's guarantee of a seat.

Backup Aircraft

Initially, each schedule involves one aircraft plus a backup aircraft. If the first aircraft fails up, the second moves in for the overflow. This means that eight planes and crews must be ready at the three stations for each scheduled departure time. At 10 p.m. for example, there are four planes at New York, the regular Boston and New York regular flights, plus the two backup planes. At the same hour, two aircraft will be ready at Boston and two at Washington for the New York-Boston plus backup.

Enters a strong tie to simplify the shuttle service both to make it easy for the passenger and to cut costs for the airline. Officials at that station of the experiment will in some degree depend on how many customers how easy it is to use the service.

No reservations facilities, with their attendant costs, are involved in the service. It is impossible to reserve a seat.

Boarding points in the terminal are dispersed from entrances, beginning 45 min before each departure. The passenger writes his name and address on the pass—thus, disposing of the passenger manifest problem in case of accident.

Flt plans are numbered and when 95 are used the flight is sold out and the backup plane is brought up. The passenger can then go directly to his landing gate where his carrier has him. No baggage weighed, and no overweight charges if necessary. The passenger puts his checked bag in a cart in the gate and hands it to the plane. If he doesn't hand a ticket he can go, his fare on the plane and get a receipt. But a ticket is acceptable, and if it was issued for a different type of service he eventually will get a refund.

Food and baggage weighing at the gate are handled by a single stand set up at the airplane's crew-servicing area, thus relieving personnel expense.

The boarding pass and receipts, as a space on its secure side for envelope

has on one side the passenger flight book on the other side. Scheduled flight. This is aimed at reducing a potential show problem on other services.

Carriers claim it would operate the backup flight for one passenger on the route. 36 people showed up for a particular schedule 1 hr, would produce a second low load factor and involve two airplanes for one passenger the plane carrying the passengers, and the airport that would have to be dispatched from its destination to replace the backup aircraft for the next schedule.

Fares for the shuttle are \$10.91 between New York and Boston and \$12.75 between New York and Washington, including tax. This is a 27% reduction from standard first class fares, and only flights higher than and coach fares.

Le Guerdin Operation

Eastern has named its La Guardia Airport operation almost entirely over to the shuttle experiment. It merely 27 daily departures were scheduled from the airport, then are now 31, all but five of which are shuttle flights. The other services have been shifted to New York and below.

A separate terminal at La Guardia will handle Eastern's flights beginning next month. The 575,000 sq ft, one-story construction work, the airline's largest, will provide its own access roads and parking lot and will be connected to the old shuttle airport as the airport. The terminal door is 193 ft from the

plane. The facility is temporary, however, pending completion of the airport's new general passenger terminal new under construction.

Eastern has set up what it calls a maintenance airport operation at La Guardia to handle the shuttle, with a impact manager in charge. There is direct telephone contact with Boston and Washington and a separate dispatching and customer service setup for the shuttle.

Experimental Service

The move is strictly an experimental effort to test traffic flow now coming in air as moving at all. Its trial runs are on Oct. 25, 1961, expansion date, and traffic counts will determine whether it will be continued, allowed to expand, or canceled before that date. The high density New York-Boston and New York-Washington markets were considered ideally suited for such an experiment.

Eastern told the Civil Aeronautics Board that a 93% load factor would meet all fully allocated costs of the service, including additional crew and other expenses of the backup flights. The airline planned to use seven piston aircraft in the service last fall but was delayed by the operating difficulties at La Guardia connected with the shuttle work at that airport.

A schedule on the temporary conditions at La Guardia and the shuttle service Northeast Airlines' passengers must move past Eastern's counter area to get their boarding gates. They fly from gate bag area, making the lower area in Boston and Washington. Some of them, according to Eastern, have perked off the Northeast line and taken the shuttle.

Shuttle passengers at La Guardia are provided with supermarket type carts to fill their bags out to the loading gates.

Reduced Fare Plan

Reduced fare, an extension plan of other airlines-Midwest and Trans World Airlines—apply on aircraft which also carry passengers with reduced space at higher fares. On Eastern's new "shuttle" services to Florida from St. Louis, Pittsburgh and Cleveland, tickets must be bought beforehand and the ticket overbooks the reservation, refundable up to 24 hr before departure.

Low fares in the "shuttle" service are building up, according to Eastern. For the three routes, last fares averaged just under 50% for December, January and February. Fares for March are 50% and for April 50%. Two daily round trips are scheduled from Pittsburgh, two from Cleveland, and one from St. Louis. Initial operation date of Apr. 20, 1961, for that service has been extended through Oct. 25, 1961.

The airline's belief that "shuttle" is providing a new market is bolstered by results of an Eastern survey which indicated that 9% of the passengers were first sales in an airline—more than at high a percentage in Eastern's system average, according to the airline. Some 22% of the passengers formerly used automobiles on their Florida trips, and 38% gave "feedback" at their usual market for using the service (AW May 1, p. 38).

Eastern has estimated that during January it averaged 47.3 passengers per aircraft, plane mile with 34.5 of passenger average per plane mile, and total revenue \$3.95 per plane mile. Direct aircraft costs for the 1049C equipment in the service were about \$1.40 per mile. The usual, the airline said, is more

up all out of product costs and making a substantial contribution to overhead.

Also in January, Eastern's Pittsburgh-Market for the passengers extended aircraft passengers of a year previous by 18.9%. Total was up 5.5% in the Cleveland-Market market and up 11% in the St. Louis-Market market. During the same month, Eastern's system revenue passenger miles and passenger loadings decreased by 1.8% and 5.7% respectively.

In the New York-Boston-Washington shuttle service, Eastern uses a different daily maximum of 1,000 seats at each station. Flares are available to meet this double that total of traffic warrants. In addition to the backup planes, plans are to schedule even more aircraft between both up as hoped.



PRATT & WHITNEY's JT8D turbofan engine will power Eastern's 727 transport. Each of the three engines, mounted at the rear of the duct to reduce noise severely, develops 14,000 hp. Each of the three engines, mounted at the rear of the duct to reduce noise severely, develops 14,000 hp. Each of the three engines, mounted at the rear of the duct to reduce noise severely, develops 14,000 hp. Each of the three engines, mounted at the rear of the duct to reduce noise severely, develops 14,000 hp.

Full-Length Bypass Duct Increases JT8D Efficiency, Lowers Noise

Pratt & Whitney Aircraft's JT8D turbofan engine, scheduled to power the Boeing 727, features a full-length annular bypass duct which is a departure from the short-length fan discharge ducts of other P&W turbofan engines.

This type of inlet, pioneered by Rolls-Royce in its Conquest series of engines, moves the cooler bypass air outside the engine and finally mixes it with the hot exhaust gases of the gas generator section. Matched mixing of the two streams at the exhaust nozzle maximizes static and minimizes engine efficiency.

Rating of the JT8D is 14,000 lb thrust at 24,000 rpm. The engine is 11 ft 11 in. long, 4 ft 11 in. high, and 3 ft 11 in. wide. It weighs 11,000 lb.

Engine runs on the test stand on scheduled currently, and later this year the company will start flight tests with the engine mounted on a transport below the bomb-bay of one of the P&W

Boeing methods—a North American B-45. Boeing will receive first prototype engines next year, and production powerplants during the last half of 1961.

The engine's two fan stages are in discharge ducts of other P&W turbofan engines. One stage is a fan stage, the other is a compressor stage. The entire component is driven through a central shaft by the last three stages of the turbofan, fan, fan, fan.

The seven-stage high-pressure compressor is driven by the fan stage's fan, fan, fan.

Over-all compressor ratio of the engine is 15:1. Bypass ratio is 2:1. Jet weight of the JT8D is 2,943 lb. Overall length of the engine is 11 ft 11 in. (slightly over 10 ft) and diameter is 4 ft 11 in. These figures show the turbofan powerplant to be only slightly larger in diameter than the J57 turbojet, and almost four feet shorter.



990 Has American Airlines Markings

American Airlines will begin taking delivery of the first 21 Constellation 990s in November. The Constellation 990 is painted in airline markings. Two 990s are in flight, one in white and one in blue.



JAT's single DC-6B operates one of the airline's five weekly round-trip services to Paris via Zagreb and Munich and one of the twice weekly round-trip flights to Cairo via Athens.



YUGOSLAV AIRLINES' Convair 440 lands at Cairo Airport. JAT plans to purchase additional 440s in the near future to replace its aging Douglas DC-6B fleet which, together with 25 four-engine Breville 14s, serve the carrier's domestic route network.



TWO Convair 440s and one Convair 140 serve JAT's intranational European network.

Yugoslavian

By Edith Wilford

Belgrade—JAT, Jugoslovenski Aerotransport, the national Yugoslavian airline, plans to introduce its first jet services by 1963.

No decision has been reached as to the type aircraft to be chosen or the one best suited to fit the small carrier's needs and pocketbook, but, with Belgrade's new airport capable of accommodating modern jetliner equipment scheduled for completion by the end of this or the beginning of next year, the question should be settled within the next future.

According to JAT's technical director, Ing. R. Radejovic, the new jet transports will be placed into service on JAT's major medium range routes such as Cairo and Paris. Convair 440s and Douglas DC-6Bs operate now against the five times a week round-trip service from Belgrade to Paris via Zagreb and Munich.

The new jets also will serve minor routes such as Belgrade-Zagreb-Varna-Frankfurt/Main. This twice weekly service was expected to be increased beginning May 6 to three times a week. The new flight, which will start stop at Varna, will be extended from President to London and will operate, even, Saturday, returning to Belgrade on Sunday.

JAT, which flies to both the East and the West and operates U.S. and Russian equipment is working on plans aimed at gaining a large share of the market, growing as trade in Europe as one moves toward boosting the country's much needed trade and tourism after the losses caused by the war. First step toward this goal was taken in 1956 when development began on the new international airport at Beograd-Kara, approximately 11 mi. from the center of Belgrade. At an estimated cost of \$8.2 million at the official exchange rate of 710 dinars to the dollar and covering an area of about 700 acres with seven jet runways, the project will replace the outdated, temporary facilities at Zvezda Airport, located about 14 mi. from Belgrade.

One of the two 10,000-ft-long runways planned for the new airport, most of the terminals and aprons are completed and erection of the main buildings, including control tower, hangars, servicing and maintenance shops, is well under way.

Jugoslovenski Aerotransport was established at the end of 1945 with a handful of Douglas DC-3s. The company is state-owned, but JAT officials here say they are given a free hand in making

Carrier to Introduce Jet Service by 1963

decisions and determining the carrier's general policy.

Total staff, including 50 pilots and about 30 stewardesses, all of Yugoslavian nationality, number 1,000 at present. Working hours are normal—hours 6 a.m. until 2 p.m., with a half-hour lunch break on duty a week [JAT says the workload had been increased to comply with the average Yugoslav airplane's desire to devote part of his day to private pursuits].

Ing. D. Marinkovic, technical director of JAT at Belgrade, says that skilled labor is hard to find and presents a serious problem in the aircraft. Other industries the building industry is particularly with large portions recruitment from programs is full swing all over Belgrade, are absorbing a great number of workers and need some 15,000 men in total to drive many enterprises away from the neighboring countryside, who are not only adaptable to modern living and working conditions, quite apart from up-to-date technical knowledge. The training of these at company expense is consequently a laborious, time-consuming and therefore costly affair.

JAT's fleet is composed of 13 Douglas DC-6s, 6 Breville 14s, 1 Douglas DC-6B, 1 Convair 440 Metropolitan, 1 Convair 140 and 10 Socrum Boeing primary trainers.

The Douglas DC-6s and Douglas 14s serve JAT's domestic network over 26 different schedules this year as opposed to 25 last year, among 32 airports. Seven of these are open on a year-round basis, the remaining five only in the summer season, but expanded airports and airport facilities at some of these will soon allow them to be included in JAT's year-round flight schedules.

Belgrade, Zagreb and Triglav are Yugoslavia's main airports, but the next year further development of Dubrovnik Airport, one of Yugoslavia's most popular seaside resorts on the Adriatic coast, and the improvements planned to be completed by 1962-1963 in Split, Skopje and Sarajevo should be fast enough along to accommodate 440s.

The carrier's aging Douglas DC-6B fleet is gradually to be phased out and JAT says it plans to buy additional Metropolitan to replace the DC-6s. The DC-6 is an all domestic machine as soon as sufficient airports with suitable installations are available to service such an equipment.

This is only the first step in the airline's airport development program now being worked out to keep step with the steady expansion envisaged over the next few years. JAT hopes to obtain permission soon to use or take over several military airports. Details are now

being negotiated with Yugoslav air force officials.

There is a total of 16 foreign carriers from both East and West serve Belgrade. JAT's home base, an irregularly scheduled flight—Sarajevo, Avramovic, CSA Czechoslovak Airlines, Aeroflot, East German Lufthansa LOT, REA, France (Roumanian) Males (Bulgarian) and Tiber (Belgian).

Douglas material means and a continuing shortage of skilled workers, the

Yugoslav carrier has shown slow but steady progress over the past few years. Compared with 1952 when 52,000 passengers were flown on its domestic network, 166,600 passengers were carried last year. On the carrier's international routes, 6,600 were flown in 1952, 51,000 in 1960.

Major command domestic services are from Belgrade to Zagreb and Ljubljana, Belgrade-Skopje, Belgrade Tito grad, Belgrade-Tivat, Belgrade-Skopje



DOMESTIC (below) and international flight routes flown by the Yugoslav carrier include a new round-trip route extension to London from Frankfurt/Main which was scheduled to be introduced on May 5.



CONVERTS FROM DRONE RECOVERY TO MISSILE SITE SUPPORT IN MINUTES

For the Air Force phase, the Boeing-McDonnell 327 was pre-manned and came severely injured, plus missing and drone recovery. And to assist in support, the 327's twin turbojet speed, its tandem rotor stability and all weather all terrain capabilities were around the clock delivery of payloads ranging from personnel to a single load of 3000 pounds or more inserted internally, externally or even hoist in or out.

These features demonstrate the all-around, all-service capabilities of the Boeing Verio 107—the logical, versatile addition to today's fast-thinking Army, Navy, Air Force and Marines.



VERTOL DIVISION
BOEING

Washington—Tailoring is a lot of Capitol Hillers' affairs' salaries, bonuses and indirect compensation, as perquisites and stock holdings for the year ending Dec. 31, 1960 is filed with the Civil Accounting Board.

[illegible]

1	0	W	nothing	the	problem	is	resolved	0.0000
2	0	0	0	0	0	0	0	0.0000
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9	0	0	0	0	0	0	0	0.0000
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15	0	0	0	0	0	0	0	0.0000
16	0	0	0	0	0	0	0	0.0000
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52	0	0	0	0	0	0	0	0.0000
53	0	0	0	0	0	0	0	0.0000
54	0	0	0	0	0	0	0	0.0000

1980-1981	1982-1983	1984-1985	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995	1996-1997	1998-1999	2000-2001	2002-2003	2004-2005	2006-2007	2008-2009	2010-2011	2012-2013	2014-2015	2016-2017	2018-2019	2020-2021	2022-2023	2024-2025	2026-2027	2028-2029	2030-2031	2032-2033	2034-2035	2036-2037	2038-2039	2040-2041	2042-2043	2044-2045	2046-2047	2048-2049	2050-2051	2052-2053	2054-2055	2056-2057	2058-2059	2060-2061	2062-2063	2064-2065	2066-2067	2068-2069	2070-2071	2072-2073	2074-2075	2076-2077	2078-2079	2080-2081	2082-2083	2084-2085	2086-2087	2088-2089	2090-2091	2092-2093	2094-2095	2096-2097	2098-2099	2100-2101	2102-2103	2104-2105	2106-2107	2108-2109	2110-2111	2112-2113	2114-2115	2116-2117	2118-2119	2120-2121	2122-2123	2124-2125	2126-2127	2128-2129	2130-2131	2132-2133	2134-2135	2136-2137	2138-2139	2140-2141	2142-2143	2144-2145	2146-2147	2148-2149	2150-2151	2152-2153	2154-2155	2156-2157	2158-2159	2160-2161	2162-2163	2164-2165	2166-2167	2168-2169	2170-2171	2172-2173	2174-2175	2176-2177	2178-2179	2180-2181	2182-2183	2184-2185	2186-2187	2188-2189	2190-2191	2192-2193	2194-2195	2196-2197	2198-2199	2200-2201	2202-2203	2204-2205	2206-2207	2208-2209	2210-2211	2212-2213	2214-2215	2216-2217	2218-2219	2220-2221	2222-2223	2224-2225	2226-2227	2228-2229	2230-2231	2232-2233	2234-2235	2236-2237	2238-2239	2240-2241	2242-2243	2244-2245	2246-2247	2248-2249	2250-2251	2252-2253	2254-2255	2256-2257	2258-2259	2260-2261	2262-2263	2264-2265	2266-2267	2268-2269	2270-2271	2272-2273	2274-2275	2276-2277	2278-2279	2280-2281	2282-2283	2284-2285	2286-2287	2288-2289	2290-2291	2292-2293	2294-2295	2296-2297	2298-2299	2300-2301	2302-2303	2304-2305	2306-2307	2308-2309	2310-2311	2312-2313	2314-2315	2316-2317	2318-2319	2320-2321	2322-2323	2324-2325	2326-2327	2328-2329	2330-2331	2332-2333	2334-2335	2336-2337	2338-2339	2340-2341	2342-2343	2344-2345	2346-2347	2348-2349	2350-2351	2352-2353	2354-2355	2356-2357	2358-2359	2360-2361	2362-2363	2364-2365	2366-2367	2368-2369	2370-2371	2372-2373	2374-2375	2376-2377	2378-2379	2380-2381	2382-2383	2384-2385	2386-2387	2388-2389	2390-2391	2392-2393	2394-2395	2396-2397	2398-2399	2400-2401	2402-2403	2404-2405	2406-2407	2408-2409	2410-2411	2412-2413	2414-2415	2416-2417	2418-2419	2420-2421	2422-2423	2424-2425	2426-2427	2428-2429	2430-2431	2432-2433	2434-2435	2436-2437	2438-2439	2440-2441	2442-2443	2444-2445	2446-2447	2448-2449	2450-2451	2452-2453	2454-2455	2456-2457	2458-2459	2460-2461	2462-2463	2464-2465	2466-2467	2468-2469	2470-2471	2472-2473	2474-2475	2476-2477	2478-2479	2480-2481	2482-2483	2484-2485	2486-2487	2488-2489	2490-2491	2492-2493	2494-2495	2496-2497	2498-2499	2500-2501	2502-2503	2504-2505	2506-2507	2508-2509	2510-2511	2512-2513	2514-2515	2516-2517	2518-2519	2520-2521	2522-2523	2524-
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J. W. Wilson, director, from June 1969, no salary; no stock, no expense account held elsewhere. J. W. Richardson, director, no salary; no stock, \$100 bonus and indirect compensation. J. E. Callahan, director, no salary; no stock, \$250 bonus and indirect compensation. D. E. Fowley, director, no salary, \$400 shares of common stock, \$100 bonus and indirect compensation. O. K. Hanks, director, no salary; no stock, \$100 bonus and indirect compensation. C. V. Johnson, Jr., director, no salary, 754 shares of common stock.

L. F. Manager director, no salary 1980 shares of common stock 1981 terms no dividend compensation. **G. H. Manager** director, no salary 181 shares of common stock 1980 term no dividend compensation. **H. Treasurer** director, no salary 1980 shares of common stock. **T. B. Secretary** director, no salary 1980 shares of common stock. **R. H. President** director, no salary 1980 shares of common stock. **R. H. President** director, no salary 1980 shares of common stock. **R. H. President** director, no salary 1980 shares of common stock.

Richard D. Burke, with gold belt stripes
 awarded March 1987. **Adm. Engr.**
McDonnell Douglas, 4001 S. Alameda, El Paso,
 TX 79907. **Mr. Burke** has been with
 McDonnell Douglas since 1964. He is
 currently a member of the American
 Society of Mechanical Engineers, the
 Society of Automotive Engineers, and the
 Society of Manufacturing Engineers. He
 is also a past president of the El Paso
 Chapter of the Society of Automotive
 Engineers.

"We have been using the GB series of tubes for about 18 months and the results have been outstanding. I started a file card system on each GB tube we had in service... a lot of record keeping... after one year, decided it was not worth the time in keeping an hourly record due to the extremely few GB tube failures we experienced during the first year."

"We greatly appreciate the interest Sylvaana has taken regarding our take problems . . . the personal interest shown toward Piedmont Airlines."

If your tube performance is less than outstanding, replace with SYLVANIA GOLD BRAND TUBES.

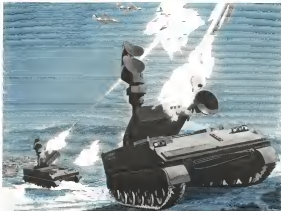
Available from 1982 Selvacore Industrial Tube Distributor

SYLVANIA

MAULER MOBILITY -BY FMC SELF-CONTAINED WEAPONS SYSTEM

The striking power of the Army's Mauler automatic-fire defense system, now in development, will be extended by its exceptional mobility—engineered and built by FMC. Working closely with Convair/Pomona, Convair Division of General Dynamics Corporation, and AROMA, an element of the U.S. Army Ordnance Missile Command, FMC is responsible for (1) the tracked carrier, adapted from our standardized M113 vehicle, and (2) the launching pod assembly and the auxiliary power unit. Result: a self-contained weapons system, tracked for on-road or off-road mobility in any terrain.

When mobility is the question, call in FMC, since 1941, a leading designer and builder of military standardized vehicles.



—FMC/ARMY PHOTOGRAPH

For further information, write on company letterhead to Preliminary Design Engineering Dept., FMC Ordnance Division, P.O. Box 267, San Jose, California. Please C/P/PS 4-1726.



FOOD MACHINERY AND CHEMICAL CORPORATION
Ordnance Division
7100 COLEMAN AVENUE, SAN JOSE, CALIF.

Putting Ideas to Work

Airline Income and Expenses—1960

(IN DOLLARS)

	Passenger Revenue	U S Mail ¹	Express	Freight	Charters	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC SERVICE								
American	337,337,434	7,819,316	4,731,191	24,236,120	1,734,041	491,853,402	394,883,379	97,970,023
Delta	48,993,244	1,993,708	861,203	3,126,448	123,292	52,997,995	39,647,529	13,350,466
East	19,143,292	2,281,746	1,541,288	1,796,166	367,493	25,129,985	19,861,019	5,268,966
Continental	46,733,807	616,341	273,277	2,233,319	91,919	47,947,663	34,833,489	13,114,174
Eastern	117,899,619	3,347,807	1,871,329	4,000,140	333,123	127,449,018	107,226,694	20,222,324
Western	242,030,467	2,243,272	2,118,576	5,495,891	191,504	254,176,529	207,443,694	46,732,835
Midland	99,603,634	7,319,721	333,613	1,222,126	1,009,009	109,288,103	73,204,090	36,084,013
Norfolk	33,349,390	566,844	395,179	1,016,915	31,134	35,359,422	43,749,140	-7,389,718
Northwest	73,244,221	2,213,108	1,252,409	4,411,897	469,919	81,587,554	64,849,888	16,737,666
Trans World	259,444,154	4,991,684	3,912,369	9,273,511	1,452,709	377,120,427	279,812,911	97,307,516
United	313,325,239	12,008,447	4,975,416	17,447,500	2,419,426	347,876,034	266,821,197	81,054,837
Western	99,722,847	1,327,714	239,449	1,370,506	444,474	102,706,990	74,412,912	28,294,078
INTERNATIONAL								
American	5,829,824	42,870	3,143	417,527	9,479	6,293,753	7,397,449	-1,093,696
Delta	9,215,499	147,429	606,316	30,428	66,799,406	111,477,361	111,477,361	-
Eastern	3,319,641	34,253	142,136	142,136	9,569,749	13,648,915	13,648,915	-
Continental	2,435,431	39,272	96,913	2,435	9,394,184	14,463,369	14,463,369	-
Eastern	10,736,734	569,736	7,874	486,846	131,232	12,382,194	39,470,232	-27,088,038
Western	1,370,800	16,147	89,799	16,147	269,799	1,742,753	3,919,799	-2,177,046
Midland	1,529,855	13,884	4,432	26,434	48,874	1,623,679	3,983,448	-2,359,769
Norfolk	30,070,719	7,176,110	55,649	4,119,972	206,204	37,582,540	35,040,883	2,541,657
Northwest	119,388,138	36,367,813	11,914,500	40,237,727	11,914,500	209,843,191	154,064,008	55,779,183
Trans World	4,999,991	206,642	3,217	49,831	26,756	5,286,433	6,168,894	-882,461
United	120,020,219	12,714,620	19,416,875	4,684,251	164,344,194	197,774,000	16,794,000	18,080,000
Western	74,512,264	2,147,447	2,147,447	2,147,447	4,409,719	81,364,324	67,474,000	13,890,324
Pacific	69,379,734	16,779,424	12,360	17,495,814	8,412,474	107,672,260	69,836,342	37,835,918
Panama	16,239,447	663,270	1,447,322	44,793	97,999,119	110,194,971	97,999,119	12,205,852
British	2,426,913	5,213,913				7,640,826	1,432,710	6,208,116
LOCAL SERVICE								
Delta	77,387,374	7,739,846	2,709,914	4,391,074	99,954,153	181,861,364	54,289,184	127,572,180
Trans World	71,495,616	471,491	41,424	420,116	67,890	72,466,537	57,323,021	15,143,516
Western	4,282,004	10,412	9,430	9,430	4,816,616	9,107,492	4,864,119	4,243,373
OVERSEAS SERVICE								
American	4,140,443	30,173	23,194	73,272	111,193	4,377,295	2,349,228	2,028,067
Continental	2,436,360	69,892	29,848	10,914	2,964,360	5,461,434	2,476,146	2,985,288
Eastern	6,320,264	177,629	54,421	122,771	100,949	6,675,735	14,997,197	-8,321,462
Northwest	9,146,641	12,945	146,815	146,815	4,807,485	14,113,896	4,782,167	9,331,729
Midland	7,379,149	145,807	131,063	102,747	247,329	7,903,098	13,326,120	-5,423,022
Norfolk	12,640,687	270,816	264,459	275,211	199,009	13,581,222	19,262,399	-5,681,177
United	7,406,983	147,473	179,623	264,329	74,450	8,068,868	13,361,623	-5,292,755
Pacific	6,186,356	149,399	49,306	56,940	607,913	7,160,014	13,383,180	-6,223,166
Panama	7,116,073	119,422	82,815	125,328	518,119	7,551,757	17,277,874	-9,726,117
Western	8,487,134	3,948,833	47,000	103,433	10,283	12,646,683	27,374,327	-14,727,644
Trans World	5,028,827	179,489	24,809	256,719	39,890	5,529,934	8,429,799	-2,909,865
West Coast	6,327,244	118,815	37,006	112,329	31,000	6,516,414	14,025,434	-7,509,020
NAVIGATOR LINE								
Alaska	4,446,432	12,841		82,011	46,910	4,498,294	2,269,894	2,228,400
GRAND TOTALS								
American	2,221,690	701,024	14,809	419,974	5,913,100	8,360,597	7,550,999	809,598
Delta	1,082,764	199,413		114,037	47,037	1,443,251	1,216,266	226,985
Continental	103,324	107,446		76,125	1,297,861	1,584,756	1,298,756	286,000
Eastern	7,367,367	89,376		48,420	12,361	7,507,531	13,316,844	-5,809,313
Midland	933,456	375,221		129,143	138,837	1,577,657	2,346,743	-769,086
Norfolk	1,149,376	206,719	31,144	1,149,376	31,144	1,517,655	2,346,743	-829,088
Northwest	1,087,514	499,824		420,130	108,223	2,105,691	3,044,614	-938,923
United	70,754	104,310		4,839	34,674	190,446	190,446	-
Western	1,121,301	414,305		341,317	69,849	1,746,772	2,346,743	-600,000
Pacific	271,673	7,436		9,116	268,942	426,746	426,746	-
Panama								

¹ Not available

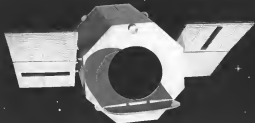
² Operating profit or loss

³ Property

Compiled by AIRLINE NEWS from the reports to the Civil Aeronautics Board.

How advanced ideas grow into reality

at Grumman...



Four capabilities qualify Grumman for advanced outer space projects:

FIRST: manpower—Grumman's labor stability has made possible the organization of a group of scientists, engineers and skilled workmen with high individual and collective experience.

SECOND: systems management ability—Grumman has repeatedly demonstrated its ability to administer complete, complex systems, from initial design to final utilization. Most recent examples are the AO-1 Mohawk, the WP-3 Triane, the ASF Intruder, and the WEP Hawkeye, all operational within the last 30 months.

THIRD: complete research and test facilities—Grumman's already extensive zero-space facilities were further expanded in 1969 by a new \$ million-dollar Electronics Systems Center which houses some of the most advanced equipment in the country. A major space environmental installation is also currently under way.

FOURTH: continuing space studies—For many months Grumman scientists and engineers have carried on extensive studies in such fields as stabilization and control, data processing, plasma physics, magnetohydrodynamics, hypersonic aerodynamics and related fields, to complement the company's outer space programs.

These four areas comprise Grumman's competence in transferring ideas into reality. This ability is being demonstrated in the Orbiting Astronomical Observatory (OAO) shown at left in an artist's impression. Conceived by Goddard Space Flight Center of National Aeronautics and Space Administration, and now under development by Grumman, the OAO will be used to study the unknown of ultraviolet radiation from the stars... the life history of stars... the regions of the extreme Lyman-beta line. 1963. Grumman Aircraft Engineering Corporation, Bethpage, Long Island, N. Y.

Advanced ideas grow into reality at...



AIRLINE OBSERVER

► **Taxed of Kennedy.** Administration thinking appears to be moving toward more centralization of U.S. transportation activities with government control tightened through closer coordination between regulatory agencies. Transmission of a transportation department at cabinet level has not yet emerged as a strong possibility. In the development of a national transportation policy, however, it is good that the centripetal of the Federal Aviation Agency, task force studies, confined to national aviation goals, and the Commerce Department task force studies, devoted to overall transportation policies, will conflict.

► **Australian Airlines and South African Airways** are showing strong interest in Sed Aviation Conville turboprop transports. Manufacturers also are conducting extended talks on a Conville order with Airbush, but the carrier has not yet reached a final decision. KLM is warring between the Conville and Boeing 727. Sed officials also have discussed their transport with Trans World Airlines and Aerolineas as the U.S.

► **Federal Aviation Agency and Civil Aeronautics Board**, concerned over increasing use of separate airports serving cities sufficiently close to be served mutually by one airport, will consider the joint airport concept as an important factor in the allocation of federal funds for airport improvement and in applications for scheduled airline service.

► **Continental Airlines** is retiring more than \$5 million in 50% convertible subordinated debentures issued less than three years ago to finance its aircraft re-equipment program. Financial concerns of the debenture holders common stock will permit the airline to buy back its equity issue, retire \$6 million in subordinated debt and eliminate debt interest costs of \$550,000 a year. Original due date on the issue was June 1, 1975. Continental plans to retire an additional \$5.1 million of 45% debentures scheduled for retirement in 1975.

► **Attorney General Robert F. Kennedy** has asked Congress to increase penalties for making false bomb reports. Kennedy has proposed maximum penalties of five years in prison and a \$5,000 fine for conviction on a felony charge of creating a bomb hoax. The idea is to cut down on the number of reports for penalties connected with a misdemeanor charge. Kennedy reports that the Justice Department has received 1,000 false bomb reports since 1949, identified 279 perpetrators, prosecuted 74 and 32 convictions.

► **British European Airways** plans a 2,000 flying hour per year reduction of its three Armstrong Whitworth Agave 690 cargo transports (AW May 1, p. 45), which is expected to produce an annual freight capacity of 16.2 million lbs net.

► **Federal Aviation Agency** traffic controllers, responding to the forced resignation of Frances M. McInerney who was executive director of the Air Traffic Control Act (AW Apr. 24, p. 41), are conducting personnel demand study, the result of ATCA's own elected officers. ATCA's management also are saying that the association's constitution and bylaws be rewritten to give local chapters a direct vote in group affairs. McInerney also announced his resignation Apr. 17, has been invited to address a May 15-16 meeting of First Region (northeast area) controllers in Boston, where the issue probably will be denied.

► **Aeroflot** has carried more than half a million passengers on its Moscow-Leningrad route since introducing 100 passengers, two jet Tu-164s in April 1959. The Tu-164s carry the 400-mi. over "the most popular air route in the USSR" in 55 days. Next summer, Tu-164s are to make up to 13 Moscow-Leningrad round trips on weekends, with some scheduled on Saturdays, Sundays and holidays.

► **British European Airways** proposal for its new terminal at London Airport would involve BEA operation of a scheduled terminal for all airlines at the field. Currently, more than 75% of all airline movements at London Airport involve BEA aircraft or aircraft of airlines handled by BEA on the ground.

SHORTLINES

► **Air Traffic Conference** has adopted new standards for quickback cabin travel agents. Agents will now post a \$10,000 bond with the acceptance of the conference demonstrate serious experience in travel and airline sales, then be placed on the conference, agency list after investigation, making them eligible for appointment by the airlines.

► **M.A. Airline**, an Argentine airline, will buy four Dutch Fokker T-27 aircraft to be delivered in March/April, 1962. The aircraft will be powered with Rolls-Royce Dart 512s.

► **British Overseas Airways Corp.** has signed a contract with Standard Telephone and Cables, Ltd., English associate of International Telephone and Telegraph Corp. for an electronic reservation system to provide information to BOAC agents in the United Kingdom and Europe for 20 weeks in advance.

► **Federal Aviation Agency** has ruled that airline pilots with less than 100 hr. in command of a type of aircraft will be held to 100 hr. ceiling and one-half-hour limitation higher than established standards. Presumably, airlines imposed such restrictions although check pilots were allowed to certify that a pilot could operate at standard landing minimums before the 100 hr. of experience was required.

► **Lake Central Airlines** has added Akron and Canton, Ohio to its system and expanded service between Indianapolis and Baltimore via Washington, D.C., Washington and Washington, W. Va. and Zanesville, Columbus and Dayton, Ohio.

► **Northeast Airlines** has sold its last area DC-4s to Ansett Building Co., Seattle, Wash.

► **The American World Airlines** has secured a 10-year agreement with Austrian Airlines to provide technical assistance to Austria's managerial and operations departments. Austrian carrier serves 24 cities in 15 European and Middle Eastern nations.

► **Piedmont Airlines** has an increasing plan allowing a "5% fee reduction on the return leg of a weekend round trip flight. The return trip must be made the same weekend or on a weekend within 30 days.

► **Seaboard & Western Airlines** changed its name last week to Seaboard World Airlines.

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Mercury Corps Lt. Col. John H. Glenn Jr., one of the group of seven Project Mercury astronauts selected by NASA for final personal training, is shown at left undergoing respiratory testing and at right emerging from Ranger 3 at Cape Canaveral, Fla., in space suit.



Astronaut John H. Glenn Jr. is shown exiting Mercury capsule shortly before it is launched to Redstone booster to undergo a flight simulation test. At right, Glenn is seen inside the Mercury capsule, checking the status of the capsule system.



Mercury Astronauts in Final



Navy Commander Alan B. Shepard dons space gear for a full ascent, descent and flight simulation test for astronaut and ground personnel preparation to check out hardware and equipment. Shepard is helped into the Mercury capsule at right.

Preparations for First Manned Suborbital Space Flight

Commander Shepard, in space suit, enters elevator to ride up to third level of Redstone gallery and enter Mercury capsule.





from the reaches of space

Unobstructed line-of-sight shows Echo I communications satellite being used to relay messages between Japan and New York. Echo I was 100 miles up.



to the depths of the sea

Actual satellite photo of telephone cable off coast of Florida.



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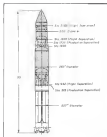


Commander Shepard is shown inside Mercury capsule. Fast sunset reflected light is prepared to boost Mercury capsule to an altitude of 118 mi. and a distance of 750 mi. in a 15-min test of astronaut's ability to withstand the force of thrust, powered flight, some 5 min. of weightlessness, and entry and landing phases (AW- May 3, p. 30).



As Vice-Capt. Virgil I. Griffin is prepared for testing in the U.S. Navy crashings at Silverdale, Pa. First sunset Mercury flight was planned to give astronaut more chance to test manual operation of flight control system than command Griffin apparently had.





SATURN G-2, for space vehicles planned for NASA's Marshall Space Flight Center's projected facilities off Florida coast, here will be a three stage configuration developing a total of almost 1 million lb thrust from stages S-I, S-II and S-IV. An additional stage S-V, may be incorporated for use with some missions. Concept for new core-aided or airframe complexes (right) planned by NASA for Saturn G-1 and follow-on versions of this space vehicle will be based on maximum utilization of existing basic designs of internal structure arrangement and form for air vehicles.

NASA Plans Offshore Saturn C-2 Firings

By Irving String

states that Saturn follow-on vehicle engines to be launched from the complex will incorporate unified stages, probably the Nova nuclear space propulsion system to be developed under NASA's Project Rover.

landmark facilities at Cape Canaveral. Marshall Space Flight Center's reputation for equipping these facilities is based on the premise that launch operations for large space vehicles must exceed the low limits of the Cape. But as the new facilities are planned, the center is also concerned with the efficient use of resources. Utilization of existing basic designs of ground support equipment and launch facilities such as employed in the VLP-11 Saturn C-1 is desired and is being projected for Cape Canaveral. Modifications for adaptability to the new vehicles in this category are expected to be held to a minimum, consistent with new requirements.

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290135	RF amplifier (Silicon)	WEL-3-10500-27A (290121)
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RESEARCH AND DEVELOPMENT AT LOCKHEED

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Lockheed Missiles and Space Division's progress transcends from that of an era marked by phenomenal scientific growth. To an important degree, the Division's research and development activities are considered to be the basis of its success.

As systems manager for the Navy POLARIS Missile and the Air Force AGEMRA Satellite in the DISCOVERER and MIDAS programs, the Division is engaged in extensive research in many diverse engineering and scientific fields. Some highlights of current research and development activities include: Operations research and preliminary design, nuclear and space physics, physical electronics, chemistry, materials, mathematics, air planning, mechanics, electrical communications and instrumentation, and computer research and development.

Research is a concept which builds many different meanings to those concerned with science and technology. At Lockheed, a distinction is made between the nature of the work and its objectives. Consequently, such terms as basic research, applied research, systems or operations analysis, engineering and development are used. A given individual might find that his personal motivation often leads him quite naturally from one type of research to another. Recognition of the close is reflected in the scope of work conducted in the Research Branches at Lockheed Missiles and Space Division. Proposed research activities are: Pure and applied research, advanced design, engineering analysis, electronic prototype development, and machine computation.

Organization is determined by the technical field rather than by the type of research. For example, a structural dynamist, as a member of the Structures Department, may, on one occasion, work on future space vehicle configurations, at another time be associated with current projects such as the POLARIS or Satellite programs, or he may be engaged in basic research in the research laboratory. In each case, the individual has the opportunity to maintain as much or as little contact as he wishes with others in his field of interest.

Important staff positions at Lockheed's Research and Development Branches in Palo Alto are available. Those scientists and engineers with experience related to the above areas are invited to write to: Research and Development Staff, Dept. M-21C, 362 West El Comodoro Road, Sunnyvale, California. U. S. citizenship or existing Department of Defense industrial security clearance is required. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

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Engineers concerned with the pumping of various aviation fluids know well the difficulties of getting good performance at high altitudes. Despite low inlet pressures, the pumps must work well at low altitudes, frequently run into trouble when they encounter the rapid pressure changes above and maintain the same performance and lowered efficiency at high altitudes.

Gravitator pumps are efficient at high altitudes and therefore are frequently specified for these engines. A specialized form of lateral gear pump, the Gravitator has a lower friction coefficient than a standard gear pump and a lower leakage rate.

The lower leakage rate means less fluid than the other and the resulting lower space is a benefit for transporting the fluid from the inlet to the outlet port. Also, speed of the chamber is reduced, the large inlet and discharge ports results in avoidance of the sudden change, rapid pressure change and turbulence which is often typical of pumps. Result in longer and improved efficiency. Thus, Gravitator pumps offer considerably good performance at high altitudes.

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Engines equipped with turbo, auxiliary power sources, gear boxes and various transmission, drive problems involving pressure fluctuations have found Gravitator type pumps successfully applied to their systems. It holds weight down and achieves maximum capacities with high service reliability.

Applications for Gravitator pumps lie in the range of pressures up to 1000 psi. They are suitable for low pressure hydraulic and servo systems, hydraulic motors, fuel, air, and water service, low pressure, low speed pumping in aircraft and guided missiles and other applications.

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lockhouse structure, electrical distribution system, and propellant system will be secondary, depending upon the basic engine vehicle considerations.

On a manned project such as the offshore launch, the construction team spent in time will be the most expensive and the most hazardous. This will prompt emphasis, as the study on design for maximum performance and to facilitate manned entrance of the structural elements to meet a preplanned sequence and method of construction. Component time and cost factors will have to be evaluated for on-site construction and floating structure problem cited structures to the offshore position.

Methods of transporting and moving lifting propellant will be investigated, particularly with regard to cryogenics since the quantities of liquid hydrogen and oxygen will be substantial for stages B11 and S1V—constitutively more than 100,000 lb and 100,000 lb respectively. Problems in that large-scale tasks will be the most feasible method of transporting these low-density gaseous fluids, but other methods, such as using flexible containers for conventional RPT fuel, may also be applicable.

Dual number of all propellants from a transport vessel to the space vehicle may have to be accomplished with the vehicle mounted adjacent to the launch pad, but because conventional levels of liquid hydrogen and oxygen require replenishing during steady ascent, it is not just to launch, a remote replenishing system and transfer lines will be required for the operation.

Hydrogen electrical power supply, in making emergency standby power, may be required as part of the offshore complex. Analysis will involve a comparison of central plant location, central supply, and launch operations, and method of handling the space vehicle stages and propellant.

The feasibility of the use of offshore facilities consists of what will be developed and compared in detail on the basis of economic, operational and technical requirements—weight, reliability, construction scheduling, support requirements and safety.

Consideration will be given to the potential expansion capabilities of such concept, in relation to how they would be affected by multiple complex requirements and the special requirements that would result from larger space vehicles and the employment of nuclear powerplants.

Also the comparison of the two approaches will be a major factor in the determination of which concept or combination of concepts will be optimum. One possibility is that the studies are underway that the space offshore facility may be the first step in the program to an offshore launch.

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Refueling Satellite

Long-term cycle engine concept under study as a prelude for USAF's proposed Aerospace Plane also has massive down potential for a satellite that would serve as a refueling station for other spacecraft, a National Aeronautics and Space Administration official said recently.

Robert Mitchell, NASA's assistant director for propulsion, told an American Rocket Society meeting on Palm Beach, Fla. that a satellite orbiting in the upper reaches of the atmosphere could collect and transfer a fuel or an oxidizer or a mixture of both to other spacecraft.

"The satellite could then act as a refueling station for a low thrust spacecraft that would maintain orbit on a continuous basis," Mitchell said. He continued that this "involves such small tanks" as reducing the size of a liquid engine plant from thousands of tons to a few hundred pounds.

"We don't see anything that will be too small," Mitchell said.

The space age is only three years old, but the companies responsible for the spectacular advances during the short period, qualified for their space assignments by virtue of extensive prior experience and knowledge. Honeywell, for example, had been designing and producing automatic flight control systems for over fifteen years when it was selected to develop the inertial reference system for Vanguard 1. A number of Honeywell flight control systems were "Eater"—elementary (for the B-47), super (for the F-105) and adaptive (for the X-15).

Honeywell inertial reference systems or precision

present the first step in the program to an offshore launch.

Replenishing propellant will require several days, quarters will be required for semi-permanent operations crew, a permanent maintenance crew, and for a limited number of transports. These quarters might be stored ship, or stored the offshore structure.

The logistic plan for the offshore structure will have a minimum amount of shipping, in keeping with efficient support of launch complex operations. Probability is that all logistical support items will be available at Port Canaveral.

Key factors in the logistic plan will be the employment of multi-purpose vessels, avoidance of launch operations, and method of handling the space vehicle stages and propellant.

The feasibility of the use of offshore facilities consists of what will be developed and compared in detail on the basis of economic, operational and technical requirements—weight, reliability, construction scheduling, support requirements and safety.

Consideration will be given to the potential expansion capabilities of such concept, in relation to how they would be affected by multiple complex requirements and the special requirements that would result from larger space vehicles and the employment of nuclear powerplants.

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FROM VANGUARD TO DYNA SOAR

*Honeywell's experience
in guidance and control systems
spans the space age*

The space age is only three years old, but the companies responsible for the spectacular advances during the short period, qualified for their space assignments by virtue of extensive prior experience and knowledge. Honeywell, for example, had been designing and producing automatic flight control systems for over fifteen years when it was selected to develop the inertial reference system for Vanguard 1. A number of Honeywell flight control systems were "Eater"—elementary (for the B-47), super (for the F-105) and adaptive (for the X-15). Honeywell inertial reference systems or precision

flight control systems have guided 30 of the 33 satellites the US successfully placed in orbit. Vital contributions have been made to space exploration, water conservation, meteorology, missiles, and manned space flight. Honeywell's role has been extended in systems responsibility on some of the most sophisticated space projects in every age. Honeywell's contributions have been backed by the full scope of scientific skills and production facilities required to do the job. Illustrations on the pages below are examples of Honeywell's proven capability... from Vanguard to Dyna Soar.

SPACEABILITY—THE CASE FOR HONEYWELL SYSTEMS RESPONSIBILITY

Guidance and stabilization, environmental control, and instrumentation—all essential to space operations—are Honeywell specialties, stemming from Honeywell's 70 years of experience in automatic control.

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To receive professional registration in other Honeywell systems, send to: Intel, Intel Corp., Minneapolis 60, Minnesota.

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Zero-Gravity Flights Test Liquid Hydrogen

Cosmos Astronautics is studying the behavior of liquid hydrogen, the fuel for the Cosmos space vehicle, under zero-gravity conditions in a series of 15 KC-135 flights scheduled to be completed in June.

Cosmos engineers are conducting the study to determine the effects of weightlessness on the motion of liquid hydrogen, bubble formation, the mixing of vapor liquid and rates of heat transfer. The company is developing the Cosmos stage, which is powered by two Pratt & Whitney LR-115 liquid hydrogen engines, for NASA.

About 15 tests are conducted during each two-hour flight with test runs providing up to 10 sec of weightlessness. The KC-135 studies are a continuation of experiments begun with a C-130A, which provided 7-12 sec of weightlessness. Over 500 tests have been run.

Cosmos conducts its experiments in a KC-135 USAF Aerospace Systems Division facility from Wright-Patterson AFB, Ohio, for zero-gravity tests.

Observations are made with a capsule 4 ft. long and 2 ft. wide which carries a 5 qt. stainless bottle containing the liquid hydrogen. The capsule is placed inside a nylon bag 10 ft. long and 10 ft. wide which is inflated with nitrogen to avoid the explosion hazard of spilled hydrogen. The capsule has high pressure venting orifices at each end to its sides and this inert gas drives a self-contained power system to operate instruments measuring temperature, pressure and heat transfer rates, plus a recorder and 16 mm. camera.

Two Cosmos engineers, wearing pressure suits, work in the nylon bag during the experiments. They approach nitrogen and hydrogen supplies between test runs. Another two engineers make observations through windows in the bag. The KC-135 pilot reorients the test with a closed-circuit television system and extends their duration by maneuvering the aircraft to keep the bag from touching the capsule.

Russians Hint At Weather Satellite

Moscow—Development of a Russian weather satellite system—similar to the National Aeronautics and Space Administration's Nimbus—has been hinted by Prof. Georgy Pukhovskiy, Soviet scientist, who said in a Tass interview that it would be "impossible to exist within the next five years a system of man-made satellites which would form several rings at different altitudes, over the earth's surface."



LIQUID HYDROGEN is contained in a 5 qt. stainless bottle inside the 4-ft. long capsule during Cosmos studies of the behavior of this super volatile rocket engine fuel under zero-gravity conditions. Tests are conducted with an Air Force KC-135 which provides up to 10 sec of weightlessness. Capsule is placed in a 10 ft. x 20 ft. nylon bag inflated with nitrogen to avoid explosion hazards. Small orifices attached to the capsule conduct high pressure nitrogen to run a power system to operate instruments and recording system.



CONVEX ENGINEERS and liquid hydrogen test capsule float in the cabin of an Air Force KC-135 during studies of the rocket engine fuel under weightless conditions. Pilot reorients the test with a closed-circuit television system and maneuvers the aircraft to keep the bag from touching the capsule, extending the duration of the test run.



DOUGLAS A-1H aircraft in water during tests of company's distress beacon, which is attached to its mast. Signals generated by transmitter beacon are reflected from antennas in floating buoys which are automatically selected by surface-to-aircraft linkages.

Lightweight Pilot Distress Beacons Tested

By Burn Miller



PROTOTYPE of Distressed Airmen Recovery Beacon (DARR) which will be able to be as small as the pocket of a pilot's flight suit. Beacon will radiate UHF distress signals for 100 hours after collapse; antenna is 10 inches from eye. Pilot package will weigh 5 lb. and its low power signals will be capable of being picked up by special airborne, phase-lock receivers on line of sight distances up to 150 mi.

Los Angeles—Two different concepts of equipping a pilot with a lightweight, retractable, long-life distress beacon which can be attached to or placed inside a pocket of his flight suit have been tested separately in recent experiments conducted by their respective developers. Each beacon can generate distress-frequency signals on which rescue planes can home directly without using special search patterns.

The beacons are small and light enough to be carried to the pilot's suit without encumbering him. Should he be required as often as he is unable to move about, the automatically activated beacons can generate distress signals needed to bring rescue planes directly to him.

One of the systems is called DARR (Distressed Airmen Recovery Beacon) and was developed by Hallam Electronics Co., a division of the Sperry Corp. in Anaheim, Calif. It employs a look-up map housed in front of a radio tracking technology which enables it to operate over relatively long distances with little power. This reduces the weight of batteries and with it the weight of the beacon. It requires short search intervals, even phase-lock tracking receivers to pick up the weak signals in the "longer line of sight" range.

The other approach, which can be

used with standard omniscient or omnidirectional beacons fitted with an adapter and two quarter wavelength antennas, is being studied at Douglas Aircraft Co. Santa Monica, Calif. This system, too, is designed to pick up very low level distress signals over line-of-sight ranges of about 150 mi.

In designing their distress beacons capable to the hardware stage, each company has gone through several stages, each smaller and lighter in design, which is its final packaged form. Hallam's DARR beacons, complete with antenna, batteries, and capable of putting out slightly more than one watt of power, would scale 55 or, the company says. This beacon would generate continuous wave distress signals in the medium distress frequency of 241 mc in the UHF range. These signals could be picked up by airborne phase-lock receivers on a line-of-sight of at least 100 mi.

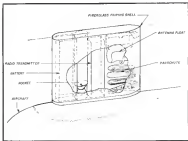
One of the Douglas beacons, made in cooperation with General Atomics Corp., Culver City, weighs less than six pounds, has power output of 125 milliwatts and generates UHF distress signals in the VHF range. It is also made for Douglas by General Atomics, weighs 13 lb., operates for 10 hr. and transmits distress signals in both VHF (121.5 mc) and UHF (241 mc) bands. In the beacons the base circuit can be switched to the VHF frequency, doubled again by a converter made to the UHF frequency. Both companies are aware these beacons are the earliest models.

Hallam's System

Hallam's system employs airborne receivers similar to the Marconi type of tracking gear which has been considered in satellite and space radio tracking. In a test conducted by the company, the beacons were flown and the receiver operated at the Hall tower plant. The receiving system consisted of one of the company's narrow-band phase-lock receivers incorporating a standard Noni-Clark receiver as an RF amplifier and converter. It across band operation, this receiver system has a signal-to-noise ratio of about -140 dbm, accounting for the low power output and requirements of Hallam's DARR beacons.

The beacon is the first consisted of a battery-powered transmitter and antenna waveguide to a crystal tuner. The power stage was a Philips MAGO TNU150 transistor oscillator loosely coupled into the antenna circuit. In this case, induced output power was 2.5 mW.

The one packaging scheme the beacon was fitted with an aluminum case with a collapsible quarter wavelength antenna mounted to it. The pilot can extend the antenna, automatically turning the beacon on.



DARR distress beacon package can be mounted on top of vertical stabilizer of aircraft as indicated above. Douglas is developing package which would be fired by small rocket upon aircraft impact; would be parachuted to the ground or into the water nearby and would then radiate distress signals. Drawing below indicates how floating beacons could have initial indication of downed aircraft would indicate UHF distress signals.

Hallam has engineered a solid state, airborne phase-lock receiver to be used in conjunction with the beacons. It is fluid-based, employs plug-in printed circuit cards. A broadband phase-lock detector occupies a card space of 2 1/2 in. square. The single channel receiver occupies a volume of 5 in. x 3 1/2 in. x 1 1/2 in. and weighs less than 10 lb., according to Hallam. Power required is roughly 1 watt at 35 v.

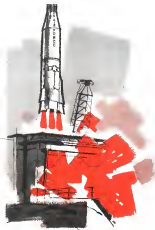
For one test, the phase-lock receiver and a standard telemetry receiver were flown side by side and both receivers attempted to pick up beacon signals in storm conditions. The company estimates, it was impossible to tell with the

standard receiver whether the beacons was radiating.

In Douglas approach, the lightweight beacons would be attached to the pilot's waist and connected by a waterproof cable to an inflatable balloon type of bag containing an antenna.

Thus, the antenna would be offset and exact should the pilot land in the water. The beacons would begin broadcasting 600 and 1,600 cps tones from a horn attached to the pilot's belt by a parachute cord.

The pilot's rescue location can be pinpointed Douglas says, with the aid of a 150 ft. transmission antenna ship for search connected to a conventional



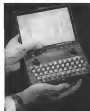
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PLUGS**



Morse Code Generator

Push button Morse code generator, MG-309 Codeunit, produces perfect Morse characters, which are transmitted at adjustable speeds of 4 to 32 words per minute. Key board contains 45 characters including numbers and punctuation. Device weighs 4 lb and was subjected to crash throughout Codeunit also can be used to provide linear coded dot/dash output. Unit price is \$1175. Manufacturer: Log Electronics Div., 1515 South Winchester, Anaheim, Calif.

Little recovery is the watch phrase. Two quarter wave whip antennas extending in opposite directions from the plane pick up the beacon signals whose relative strength is compared by the adapter. The adapter feeds signals to a left-right meter mounted on the pilot's instrument panel. The meter is at zero when the antennas are at right angles to the beacon, will dip sharply as the pilot passes over the beacon thereby indicating the location of the downed pilot.

Douglas engineers estimate that an ARC-27 airborne military receiver equipped with the antenna adapter could receive signals from its beacon at distances up to 100 or 120 mi. The small receiver, receiver with an ARC 25 military adapter might pick up the signals out to 25 mi.

Tests of the Douglas system were conducted by the company near the Mojave Desert and over the water. For reception in mountainous areas where a downed pilot might be situated in a gulch, the search plane can be equipped with a high-gain Yagi beam antenna to boost the range of signal reception. Pilots have been recovered 5 mi after takeoff of the rescue plane 55 mi away, according to Douglas.

Douglas is trying to reduce the service in an emergency under system utilizing the same beacon attached to the side of a life raft. The beacon

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VE-5 (1923)



F4U (1940)



Regulus (1953)



F4U (1940)



Regulus (1953)



F4U (1940)

For 40 consecutive years, the Navy and Chance Vought together have strengthened national defense and hastened aviation progress. In 1923, VE-5 went aboard the Navy's first commissioned aircraft carrier, the USS Langley, to prove that air power could go to sea. In the 02U-1 Corsair, received in 1926, Navy pilots captured four world's performance records. Pilots of the F4U Corsair fighter registered an 11-to-1 kill ratio during World War II, and the Corsair remained in production 11 years—longer than any U. S. fighter before or since. In 1953, the Regulus attack missile presaged a mighty deterrent with its first successful launch from a submarine. In 1957, carrier striking speed shot past 1,000-mph with delivery on the FBU Crusader. Today, Navy and Marine Corps fliers maintain the Free World's border-watch in more than 700 Crusaders. Tomorrow? Wherever the next big challenge lies—in manned space flight, or in further mastery of the atmosphere—Chance Vought is equipped to help add more great hours to the history of Naval Aviation.



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SPERRY

Some typical Sperry programs benefiting from Value Analysis: (left to right) SP-3 Automatic Pilot for light aircraft; Army's SERGEANT missile system; Ray's Mark 33 Gun Camera; GSA's APN-80 Airborne Radar System; Raytheon tubes for long range radar systems (near distribution).

it could be turned on when the suit inflated.

A number of companies, interested in rescue beacon work, have been developing devices for this application over the past years.

In the past, the relatively large, bulky "Gibson G-1" rescue beacons were generally standard equipment for the life rafts of commercial planes on oceanic flights. Operation of the "Gibson G-1" has long been felt places too great a demand on distressed people who may be sick or injured in a life raft. About a year ago, however, Granger Associates ARB-81P electronically operated rescue beacons standard equipment for the life rafts in its planes on transoceanic flights (AW Mar. 14, 1960 p. 57). The Granger beacons currently in use electronically with other radio beacon as carriers and is carried on a number of electronic aircraft.

Granger Associates beacons weigh 90 lb., transmit on 121.5 mc. for up to 48 hr., and have a 150 mi. range for aircraft at 50,000 ft. altitude. Their 100 ft. is making what it regards as a competitive beacons with comparable operating characteristics which weigh about 45 lb. Like the Granger beacons, the Thorne device will operate automatically when it lands in water.

Douglas also is developing a beacons

package which can be mounted on the tip of the vertical stabilizer of an aircraft. The package is mounted on longitudinal support a damping switch is mounted and a small rocket fires the package into the air where it would parachute, open and begin the package to a soft landing. The helium airbags inflate and the beacons go on the air. Present plans Douglas capacitor air container a beacons with sufficient batteries for 5 hr. of operation. The company says it hopes to demonstrate the concept in Honolulu during June.

A similar concept for a beacons located on the aircraft's vertical sta-

bilizer was developed some time ago by the Canadian Research Council. Unlike the proposed Douglas device, the Canadian Cross Position Indicator required a special antenna.

Generally speaking, the past several years there has been considerable amount of activity in the rescue beacons field conducted by the companies already mentioned as well as Fairchild, Richardson and Madsen. Much of this work, according to some workers in the field is hampered by the confusion in the field as to whether the beacons belongs to the pilot, his kit, raft, his spouse and/or some of these.



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tapes during editing according to MSVD's film, J. Hays.

The actual alignment and course synchronization of the two original tapes the station time code recorded as the tapes is used. The greater precision, the shorter, non-saturating time code also is used, permitting the two tapes to be synchronized to within 50 msec. accuracy, according to Arthur Westcott of Durling.

The composite tapes can be processed through conventional pulse amplifiers and pulse duration modulation (PDM, PDM) discriminators without data content, Orlikoff says. If desired, the tape editors can be built to automatically edit three or more tapes simultaneously to produce the composite, according to Westcott. Orlikoff's address is P.O. Box 57, Princeton, N.J.

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► **Electronic Component Sales Up.** Shipments of electronic components in U.S. manufacturing were up about 4% in fourth quarter of 1969 over same period in 1968, placing the year's total approximately 10% above 1968. Unfilled orders at the end of 1969 were about 5% above those of a year earlier, amounting to about 11 weeks' production at the fourth-quarter rate.

► **Transparent Plasma Investigation.** Research done with conduct experiments intended to confirm those which indicate that plasmas surrounding re-entry vehicles can be made transparent to very high frequency radio and radar signals by mixing a low-frequency wave in the plasma, company's Dr. J. F. O'Connell reported at recent meeting of American Physical Society.

► **Radiation Resistant War Developed.** New radiation resistant war were where utilization opportunities in space radiation flux combined with solid and magnetic materials, has been developed by Radiation Materials, Inc., a company jointly owned by Local Electronics Corp. and Radiation Applications Inc. New war is 90% lighter than conventional plastic material used in war and less expensive, according to manufacturer. Address: 16-40 71st St., Long Island City, N.Y.

► **High Temperature Electric Power System—General Electric** has demonstrated an electric power generator system which can operate at temperatures up to 3600° and some components can operate at even higher temperatures. System, known as Hot Flow, was developed under subcontract to North American Aviation as part of an Air Force sponsored program. The



Canada Displays Topside Sounder Satellite Model

Model of Canada's ionospheric sounder satellite, to be launched into a 700 mi. polar orbit late this year by a Thor Delta vehicle (AW Feb. 29, 1969, p. 25). Satellite will use orbit in a steep dipperion scanning technique to probe top edge of ionosphere.

boarded radars, including generator, regulator and controls, has been operated at temperatures ranging from -60° to 600°. GE has "Next step in the GENNA program is to construct and test prototype system capable of providing parallel-generator service.

► **Air Force to Test Unfusable Antennas—Air Force's Aeronautical Systems Division, Dayton,** will evaluate certified plastic unfusable antennas developed by Lockheed Martin and Space Division and Sylvania Co. for possible use as space vehicle antennas (AW Apr. 24, p. 55).

► **Signal on the Dotted Line—Mapco** contract awards recently announced by agency manufacturing include:

► **Electro Nuclear Systems Corp., Minneapolis,** has secured Office of Naval Research contract for study of nonlinear noise, to be carried out by company's Technical Research Div. in Bethesda, Md.

► **Caplight Corp., Richmond Hill, N.Y.,** has USARL contract for \$147,800 from Rome Air Materiel

center, production of 45 AT-90M/GPS radar antennas for AT-90 (definitely) purposes. The value for \$77,000 is for "Autostar" interference reduction study at 10 Air Force bases, to be completed by end of Mar. 1961.

► **Bioscience Research Bureau, St. Paul,** contracts totaling \$700,000 for production of automatic antenna systems for use with high frequency radio communication sets on Air Force B-36 and KC-119 aircraft.

► **Rockwell Bell Electronics, Los Angeles,** \$700,000 from Navy Bureau of Weapons for production of automatic communication and identification equipment.

► **Heaton, Furber Corp., Boulder Hills, Calif.,** \$16 million for design, manufacture and installation of operational support equipment for Defense Systems, Missile program at Lockheed Martin and Space Division.

► **North American Automatics, Day, Davenport, Calif.,** \$42.5-million Army contract for 25 additional portable precision gyro direction finders known as ABLE, for establishing antiradar measurements.



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• Integrated computer NOR logical circuit, packaged in a D0-5 miniature case. Tenets of three diodes in AC can plug network, a transistor and two resistors. All semiconductor elements are fabricated from silicon. Design specifications are available from manufacturer: Raytheon Co., Serviced after Div., 235 First Ave., Needham, Mass.



• Magnetic core memories, destructive and non-destructive types for airborne and space applications. Memories provide two independent read-write cycles. Current variations of -10% and frequency changes of -50% can be tolerated without external compensation. Manufacturer: Litton Systems, Inc., Woodland Hills, Calif.

• Power transistors, Series WX118N and WX118AL, an ultra-low noise



noise power gain up to 1,000, low saturation resistance and low thermal impedance. These transistors are capable of dissipating 150 mW at case temperatures of 75°C, maximum permitted junction temperature is 150°C. Thermal resistance is less than 4 deg. C per watt. Manufacturer: Westinghouse Electric Corp., Semiconductor Dept., Youngwood, Pa.

• Miniature temperature transducers, resistance type, low sensitive element which measures 0.1 in. dia. and 0.15 in. long. Maximum range is 25 mV or less and repeatability is quoted at within 0.04%. Transducer is hermetically sealed to withstand up to 6,000 psi and meets MIL-E-8773C shock and vibration according to specification. Western Instruments & Controls, Co., 11799 West Pico Blvd., Los Angeles 64, Calif.



• Alpha-numeric display model, Type IL-200, can display any one of 64 in. dual-digit characters which are spaced from a 6 bit binary input or any one of 16 characters when operated from a 4-bit binary input. Display can change from one character to any other in less than 50 microseconds and can hold on character on display without drive on input circuit. Device measures 44 in. long by 12 in. high and 1 in. wide and weighs 94 oz. Display is internally lighted with characters measuring 0.5 in. in height. Manufacturer: Servo Micronics, Inc., 200 N. Arroyo Blvd., El Segundo, Calif.



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BY ELGIN MICRONICS

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HIGH-WING LAYOUT of Model 1121 Jet Commander, shown on full-size mockup, was chosen as most efficient aerodynamically (qualifies fast, allowing extensive lifting). Flight-type entrance door is pressure-rated cabin is on left side, behind the cockpit.

Aero Commander Building Executive Jet

By ERIC J. BAUER

Oklaheima City, Okla.—Palm are being set here by Aero Commander, Inc. for a new four-to-six passenger twinjet business plane, scheduled to make its first flight in April, 1962.

The company is aggressively planning a production schedule which calls for initial deliveries of reconfigured Model 1121 Jet Commanders from the factory in the summer or in the fall of 1963.

For a price of approximately \$590,000 customers will get an airplane fully equipped with interior and electronics including radio and distance measuring equipment, powered by two General Electric CP-1014 turbojets delivering 2,850 lb thrust each on takeoff. The airplane will also be available, even electronics for approximately \$475,000 to those customers who prefer to have custom installations of this equipment made in the field.

Basic Design Parameters

Basic design parameters are aimed at providing business executives with a private jet certified to operate at altitudes up to 40,000 ft, capable of cruising at Mach 0.8 at 20,000 ft and showing a range of better than 1,700 mi with adequate fuel reserves and with the ability to operate from

any airport now used by the company's turbo-prop engine, Commander.

Typical flight profiles and other performance discussed here at the factory with American Wings point up the Jet Commander's capabilities that will be provided because executives operating this class of private jet.

• **Los Angeles-Oklaheima City flight** covering 1,625 statute mi., would take 2 1/2 hr from takeoff to landing. Jet Commander could leave Los Angeles at gross weight of 14,000 lb, climb at maximum continuous engine rpm to 35,000 ft, cruise altitude covering 70 stat mi in the climb to level-off, using 740 lb of fuel in the process and getting cruise altitude in 0.25 hr from sea level.

At 35,000-ft optimum cruise altitude, the Jet Commander would fly to Anacostia at distance of 765 stat mi, cruising at 540 mph true airspeed. Jet down would start at Anacostia, where the airplane reached in 1.75 hr, having used 2,050 lb. at low-rate fuel. Descent at Anacostia would be made to 5,000 ft at speed of 757.5 mph, using 517 lb of fuel during the descent, which is accomplished in 0.57 hr. There is an allowance of five minutes holding at the 5,000 ft altitude to await the arrival, at 230 mph, using 160 lb of fuel in the process, then descent rate

Oklaheima City Airport, allowing 33 min for this and using 157 lb of fuel. Fuel reserve at the end of the Los Angeles-Oklaheima City flight would total 1,842 lb.

• **Takeoff distance** of 1,900 ft will be required on a reroll due at sea level, with the airplane at a gross weight of 14,000 lb, entering normal technique, and refueling this now at 131 mph. Using short-field technique, takeoff distance would be approximately 1,400 ft. On a 3,000-ft airfield the airplane could be lifted off at full gross with normal technique in 2,555 ft. Aero design includes:

When operating from a 5,000-ft airfield, runway, the Jet Commander will get off the ground on a standard day at full gross in 2,785 ft and on a 100-deg day in 3,370 ft using normal technique in those cases.

• **Climb performance** for the Model 1121 indicates that on two engines, the airplane will climb from sea level at 700 fpm and at 15,000 ft it can climb at the rate of 1,900 fpm, both performances calculated on the basis of full gross weight. Maximum climb speed on two engines at sea level is 482.5 mph.

Single engine rate of climb at 14,000 lb weight is approximately 2,100 fpm, with single-engine maximum climb speed being 247 mph at sea level.



GE C410-1 turbojet engine (left) weighs 554 lb and delivers 2,850 lb thrust on takeoff. It will be FAA-certified this year. Cockpit panelization provides engine and communications controls on central pedestal. Wheel yoke is part of standard equipment.

• **Engine** is designed for a single engine output of 15,000 ft at 10,000 lb weight. Going on two engines, at 14,000 lb gross weight is 40,000 ft, at 12,000 lb it is estimated as 43,000 ft, at 10,000 lb weight it is estimated as 45,000 ft, and at 8,000 lb weight it is estimated as 47,000 ft.

• **Wing speed** goes all the way to configuration and at approximately 5,100-5,800 lb landing weight is estimated as 59 mph.

Company executives here, from vice-president general manager Tom Harris on down, emphasized to American Wings that Aero Commander ran in the program hand with both fact, convinced that a vacuum now exists for a pre-engineered executive transport in the class that such an airplane is technically feasible due to availability of the proper powerplants.

management feels that sooner or later some manufacturer is going to move to fill the gap that exists and it has moved to push the initiative.

Aero Commander feels that there is going to be a limited market, at least for the first two or three years for this two-engine class airplane, and the first company to provide a reliable vehicle is going to establish an enviable commanding position in the market. The company likes the situation to that which caused price to the advantage of the first pre-engineered U.S. answer and points to the top dog position achieved by Boeing as a result of chugging off the market when competitors and convincing the company to a first position program in advance of its competitors, then pointing hands into the program and refusing to be "kicked out" by other contenders.

Indications are that Aero Commander feels that its size and management makeup allows it to move faster and at lower overhead costs than possible U.S. competitors.

Two projects in this area are the North American T-38 and the Douglas P-700 airplane (AW, May 1, p. 47). It thinks that it also can beat foreign programs, such as the Swiss SAAC 73, the Israeli B-101C, the Model-Peter CM 191 and the Hawker-Siddeley DH 125 on the basis of natural U.S. resistance to foreign aircraft or low production capability.

Desires to go ahead and begin expanding company funds on the Model 1121 was made a year ago and the company started work on the first of a series of working last fall to avoid the kind production configuration leading to its distribution dealer organ-



CABIN is approximately 41 in. wide and 5 in. higher than Model 680 Commander. It sets two in standard layout, so for high density. Galley at between aisle and cockpit, separated by door. Passengers have automatically-deposited emergency oxygen system.

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Fin/fairing	1,445 lb
Landing gear	930 lb
Cybernetics	197 lb
Controls	280 lb
Propulsion	1,030 lb
Equipment Group	
Fixed systems	199 lb
Electrical equipment	481 lb
Instrument panel	180 lb
Radio	31 lb
Batteries	110 lb
Permanence equipment	179 lb
Oxygen equipment	56 lb
Food and water	45 lb

at the a factory meeting rather than in the field.

Company has been conducting market surveys for years, including those made for it by outside firms, but it finally admits that beyond indications that there is a need for such an airplane, there is a large element of gamble in that it will have to develop the market itself over a period of years and it cannot now predict backlog. Expanding department is moving at an accelerated pace into developing the airplane, vice president-engineering Ted Smith indicated that a prototype backlog is under way to keep the project moving on schedule.

In keeping with Aero Commander's previous practice, the initial production prototype Model 1121 will be built at the company's Norman, Okla., development and engineering center, and as usual, ascent will be in getting the first airplane built and flying as quickly as possible, with a guarantee of wind tunnel research. Smith pointed out that the guarantee has been very effective in the past in speeding the development-to-production cycle and that the company's experience in using full-scale prototypes rather than extensive wind tunnel studies has been very successful. The designer can go only as far as the wind tunnel collecting free data from those on much of the data is largely theoretical and may not give out well when the prototype takes to the air, he notes. Competitive cost of modifying part full-scale prototypes as against the cost of long detailed wind tunnel programs is very favorable, he feels.

Some wind tunnel studies will be made at the University of Oklahoma's 500 mph tunnel, using a 1/10th scale model for flow studies.

Actually, the airplane does not reach into the performance area where exotic

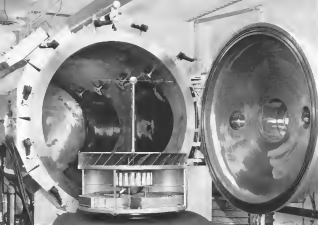


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PROGRESS REPORT: BENDIX SPACE LABORATORY Another addition to our expanding Space Laboratory is this 4 x 8-foot space simulation chamber now operating at 4×10^{-9} mm Hg vacuum. We understand this is the hardest vacuum yet achieved in this size chamber. Integral wall heating and cooling allow test of small satellites and satellite subsystems at temperatures ranging from -300°F to $+500^{\circ}\text{F}$. Accessories extend this range to -400°F to $+2000^{\circ}\text{F}$. Our expanding facilities are creating career opportunities for senior personnel experienced in satellite and space system testing.

BENDIX SYSTEMS DIVISION

ANN ARBOR, MICHIGAN



Model 1121 Jet Commander	
Wingspan	49.51 ft.
Length	47 ft.
Height	34.71 ft.
Gross wing area	303.5 sq. ft.
Wing loaded area	NASA 64-6-112
Wing aspect ratio	6.19
Wing taper ratio	0.33
Sweep angle of quarter chord line	
	4.61 deg.
Total internal area (2)	19.24 sq. ft.
Total horizontal tail area	70.86 sq. ft.
Total elevator area (2)	17.21 sq. ft.
Total vertical tail area	45.68 sq. ft.
Rudder area (including tabs)	31.41 sq. ft.
Altimeter area	74 sq. ft.
Radar area	57 sq. ft.
Fluxmeter area	98 sq. ft.
Horizontal tail aspect ratio	5.935
Horizontal tail taper ratio	0.50
Horizontal tail swept angle	NASA 64-6-112
Vertical tail aspect ratio	5.919
Vertical tail taper ratio	0.3764
Vertical tail swept angle	NASA 64-6-112
Wing wetted area	518.87 sq. ft.
Wing wetted area	126.15 sq. ft.
Vertical tail wetted area	89.84 sq. ft.
Horizontal tail wetted area	142.87 sq. ft.
Nozzle wetted area (2)	123.86 sq. ft.
Nozzle throat wetted area (2)	11.49 sq. ft.
Empty weight	7,900 lb.
Maximum gross weight	14,000 lb.
Fuel capacity (maximum)	990 gal.
Cabin length (inside)	99.80 in.
Cabin width (inside)	58.18 in.
Passenger compartment length	205.75 in.
Landing gear	27 x 56 x 59 in.

design traits need to be incorporated, such as sharp leading edges, complex fillet and stream systems and the fillet, and much of the design can be considered straightforward.

Bentch emphasized that a person can't go to develop an airplane requiring a minimum of transonic flow. As the part of a piston engine jet is concerned, an aircraft engine is developed considering transonic flow from the Commander 6808. Bentch feels that a good 6808 pilot's main concern is making the transition to the Model 1121 will be in recognizing that he is flying at a rate that has the speed of the piston engine that approach transonic flow will take more time, technique must be developed to come down from high speed flight to approach jet piston speeds smoothly and more careful flight planning is required. In the low speed regime the jet airplane should pose as difficult handling problems. Bentch pointed out that the Model 1121 has a wing loading of some 14.3

lb./sq. ft. at landing weight compared with approximately 24 lb. for the Model 6808 at landing weight. Even at gross weights, there is no radical increase in wing loading, the Model 1121 having 46 lb./sq. ft. at 14,000 lb. gross weight as against 12 lb./sq. ft. for the 5,000 lb. Model 6808. Other design characteristics are also similar. Fuel management systems on the jet, for example, will be nearly identical with that used on the Model 6808.

Final configuration in the realization of studies going back some seven or eight years, including early thoughts on adopting the piston-engine, high wing airplane in jet power by Langley. The main jet is under the wings in pods. But design limitations generated performance goals that did not warrant the cost of such a program. More sophisticated was a latest developed T-6000 planned in 1955, which later time transducer to the Model 1121, but which was a high-wing airplane, with two GE CJ-610 or two PW-112 turbojets located in the fuselage behind the cabin. But in order in the leading edges of the wings of the main wing having two turbojets exhausting out of the rear of the fuselage. Landing gear is retracted into the bottom of the fuselage.

Analysis indicated some ducting losses because of the need to bend air flow from intake to engine intake and long tailpipes, necessary for a relatively complex wing structure to take space around the intake, since resistant to having engine located near the cabin area because of possible shock losses and greater complexity in landing gear design. Indications are that this layout would have resulted in an airplane, costing at least \$10,000-\$15,000 less than the current configuration.

Air Engine Design

Design analysis indicated benefit of putting engines in pods on rear of the fuselage—permitting a clean wing. In fact, low likelihood of adopting foreign turbojets, induction in new level is to develop and cabin—placing wing in rear and fuselage. Indicated the various aerodynamic efficiency and maximum flow uncompressor with engine intake. Indicated both the GE CJ-610 and PW-112 powerplants were considered since thrust performance was as similar that those would be relatively minor design problems in fitting other type. Indications are that Air Com Commander considered using the CJ-610 as the standard engine, making the T-12 optional at the customer's desire to a higher price, but then a few weeks ago, PW-112 made a price increase of some \$6,000 on the T-12 and the air frame manufacturer felt it could no longer consider offering this engine as



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Magnavox continues to maintain a position of leadership in the airborne communications field.

Magnavox engineering, in conjunction with the Air Force, has developed an advanced airborne communications system that is designed to meet the requirements of the future. Utilizing wide band techniques, such functions as television relay for bomb damage assessment, data link for control and identification, and many other forms of air-to-air and air-to-ground communications can all be realized over the same equipment as used for voice.

Magnavox

AN/ARC-50 SYSTEM



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part of the Model 1123 program.

Wing geometry (conventional) has been permanently joined at the first, large center line behind the delta. There are two more spars. A sub-span covering attach points for main landing gear and flaps, and holds the approximate 16 in. to 12 in. apart. Spars will be machined in one piece from forging and/or blisks on spits, and will in composite integral spar cap flanges, then web and all ribbing members. Wing ribs will also be machined from aluminum alloy plates, starting with one end stock, working across material off so that the ribs are tapered from 0.04 at the root to 0.06 at the wingtip. Landing edges will be scratch machined with integral ribbing except that they stop at the leading edge, in order to permit leading the skin in the proper contour. All wing cut areas where access flaps are to be fitted, will also be scratch machined using no clearing process.

All structure will be sealed to permit using the entire wing as an integral fuel tank. Fuel tank system providing 1 hour of 500 gal. of fuselage storage will comprise three tanks. A 125-gal. center tank will be located in the fairing area and ribbing will extend to reflect possible stress hazards encountered in a crash. There will be two wing-mounted outer tanks. Center tank would be used for takeoff and cruise to the end of the flight; the pilot would switch to the right and left outboard tanks.

Simple, light-type wing flaps, comprising 55% of total wing panel area, are fitted at 75% of the chord line and can be depressed 10 deg. Ailerons are 100% main-belted and cover approximately 55% of the span area of the wing panel. In addition, the ailerons contain an 8% section main-belted. Wingtips are built up of structural plate and are approximately 3.4 in. long.

All structure is suitable to the wing load, wing two spars machined to provide integral spar caps above ribs.

Subcontracting Required

Orlando City, Fla.—Inquiry, and need analysis of Model 1121 Jet Com. center wing data and fuselage layout will require subcontracting of these two projects to firms having specialized production facilities capable of turning these parts since Auto Commander data and jet wing such equipment. The production probably will also apply to the airplane's wing area, although Auto Commander quality may be less work after the initial analysis or build. From materials used in the airplane are 2024, 7075 and 7075 aluminum alloy.

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Transliterated control circuitry requires high-speed, accurate, reliable operation. The EAI Series 3100 DATAPLOTTER makes readily available a low-cost tool for fully analyzing experimental design problems. It is particularly applicable to data reduction and instrumentation calculations. As a measurement tool, it is valuable for the conversion of computer intelligence to graphic representation of sales, production and cost data.

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Electronic Associates Range Instrumentation equipment includes:

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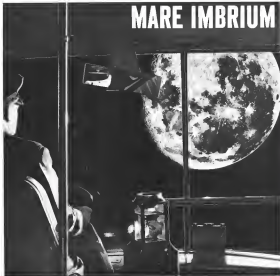
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NEXT STOP: MARE IMBRIUM



One of the primary needs in the next generation of our space program is for a suitable "space bus"—a vehicle versatile enough to carry a variety of exploratory payloads to the moon and possibly to the near planets. Once it is injected into a lunar or planetary trajectory, this bus will have to guide itself to its destination, accomplish a soft landing, release and activate its payload.

The problems involved in the design and fabrication of such a vehicle, as well as the numerous payloads it might be expected to deliver, are being intensively explored at Northrop. These investigations cover guidance, communications and position sensing systems, thermal and environmental conditioning, structural and material development

and a host of other re-usable capabilities. Expanded working groups in all essential areas are coordinating their efforts in the search for practical, unexplored solutions to these problems.

This determination to research problems as thoroughly as possible, the ability to conceive such a wide range of technologies toward their solution, and the added ability to translate the results into working hardware are prime assets of Northrop in the space race.

NORAIR
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NORTHROP

Jet Commander Performance

Cruise speed (28,000 ft. and above)	Mach 0.8
Cruise speed (under 20,000 ft.)	419 mph
Stall speed (clean)	313 mph
Stall speed (landing configuration)	95 mph
Maximum speed	236 mph
Never exceed speed at sea level	477 mph
Max. landing gear down speed	187 mph
Max. flap extension speed	171 mph

door integrals, cabin pressure and gear. Landing gear system is designed so that by actuating a lever located on the master pedestal, the main gear can be lowered to and on landing at air speed up to 250 kt. true airspeed. Selection is lost out so that should the nose gear require lowering, in complete gear down procedure, the lever on the pedestal must not be activated. All the pilot has to do is push the normal landing gear lever down on the panel and the work is completed with the main gear lever automatically actuating to "down".

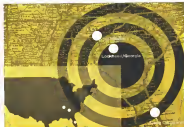
Cabin pressurization system is of the automatic type, operated by the rate in the left seat who sits in altitude to be used and one of climb program after engine start. It is started by means a button to activate the system and it automatically handles pressurization to specified. Cabin pressurization is furnished by dual airframe compressors, either one of which will supply sufficient capacity to maintain normal operating cabin pressure of 7.5 psia equivalent to 5,000 ft. altitude, when the airplane is at 32,250 ft.

Pilot and passenger cabins are fitted with separate oxygen systems, with masks in the cabin, falling down automatically from overhead in situations. Cabin has seven 16-in. x 15-in. high porthole windows, four on the right side, three on the left.

High-pressure, demand oxygen system provides a duration of 30 min. at 35,000 ft. for the pilot and 30 min. for each of four passengers at this altitude.

Instrument panel lighting is the indirect type consisting of a group of small and white lights recessed with tubes of one white to eight and along the inner edge of the panel. Lighting can be used in intensity for all-white, off-red or mixed red-and-white, at the pilot's choice.

Standard communication equipment will include two transmitters and two receivers. Navigation system will be a dual setup, with two VHF receivers, a marker beacon receiver and two glide slope receiver. Sperry SP-5 integrated with integrated altitude and approach



STRATEGIC AEROSPACE CENTER • Lockheed/Georgia is next door to Huntsville and Cape Canaveral. This strategic geographic location eliminates excessive transportation costs, enables technical liaison more efficient and reduces the overall time span of aerospace programs. And the Georgia Division is big enough physically to handle any program yet conceived—big enough in capability to take on the full gamut of advanced research and manufacturing jobs. **LOCKHEED/GEORGIA**
MARLETTA, GEORGIA

PROBLEMATICAL RECREATIONS 65



Assuming that each pocket of cigarettes bears a certain monetary fraction constant, as a premise, one of a set of 52 playing cards, and that these cards are distributed among the pockets of smokers (the number of pockets available being infinite) what is the average monetary number of pockets that must be purchased in order to obtain a complete set of cards?

—American Mathematical Monthly

Re-up of the complete picture at Litton Industries 27 plants and laboratories, over 60 foreign subsidiaries, more than 1,500 sales and service branches in 93 countries throughout the Free World. Our business: Defense Equipment and Systems, Business Machines, Communications, Components, Geographical Research and Instrumentation.

ANSWER TO LAST WEEK'S PROBLEM: Since every integer has a unique decimal representation, every non-negative integer product of X will appear exactly once in the product. Hence the product equals $\sum_{n=0}^{\infty} 2^n = \frac{1}{1-2} = -1$.

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CHEMICAL EXPEDITIONS BY

Monsanto Research Corporation . . .
mapping pathways to unique molecules that
solve difficult military and industrial problems

Exposure to the rapidly expanding aerodynamic, electronic and mechanical stresses are hampered by having to overcome their own inherent weaknesses that are "on hand." Monsanto recognized this problem as vital to defense and to industry, and established the Monsanto Research Corporation, a wholly owned subsidiary with research facilities largely devoted to study of military problems facing our government. The Monsanto Research Corporation is seeking open/total solutions toward solving a number of today's critical material needs.

The Monsanto Research Corporation conducts research and development programs to produce special new materials to fit specific requirements. This laboratory focuses the scientific resources of a major chemical company on creating special molecules. Here, basic science and applied technology in organic, inorganic, polymer and petroleum chemistry are integrated in the creative expedition.

Available to the government and prime contractors for contract research, the Monsanto Research Corporation provides the maximum probability of success success in developing chemical materials for space-age technology because the "know-how" and research effort are concentrated in one well-rounded organization. It is currently at work in a number of vital areas of technology:

SOLID PROPELLANTS . . .

For the Bureau of Naval Ordnance, exploring a complete new type solid propellant with promise of advantages in specific impulse, safety and processing. Details on this project are classified. Information is available through the Solid Propellant Information Agency.

HULL-VIBRATION DAMPING . . .

For the Navy, Bureau of Ships, developing plastic coatings to damp vibration of metal parts. Results has developed a mathematical formula that relates actual engineering damping to fundamental constants of the polymers. Developed to date a series of compounds that promise to be twice as effective as any previously known.

HIGH-HEAT-STABLE FLUORINE COMPOUNDS . . .

showing the most promise for use as high-temperature lubricants and fluids for the Air Force. By critical screening, Monsanto research has determined that perfluorobenzene appears to be a highly heat-stable building block. By

aromatic various types of compounds, this order of heat stability was disclosed: certain esters greater than 1000°F.; special aromatics—up to 1000°F.; nitrogen heterocycles—up to 900°F.; silicon compounds—up to 800°F.; phosphorus compounds—up to 500°F. Several major holes of fluorine chemistry have been "blended out" and the research began for heat-stable fluids, fuels, and lubricants.

CONTROLLED-PERMEABILITY FILMS . . .

research for the Office of Saline Water on plastic sheeting that can rapidly pass water but retain the ions of dissolved salts. These films would have a controlled permeability based upon their molecular structure—in effect, hold promise for separating a variety of salts from solution and specifically for purifying sea water.

INORGANIC POLYMERS . . .

for the Air Force—investigating the bond strength of linkages between various combinations of elements to find "plastics" composed of molecules with phosphorus-to-carbon-to-sulfur bonds; neosiloxanes with iron bonding; nitrate chloride cross-bonding; and several types of metal-phosphorus-carbon linear polymers.

HEAT-RESISTANT ADHESIVES . . .

for the Air Force—polymers to develop high bond strengths between dissimilar materials at elevated temperatures. One series of polymers may yield useful-to-metal bonding that holds firm at 500-700°F., might be used to glue covers together—and in many places to eliminate welding.

HIGH-TEMPERATURE LAMINATING RESINS . . .

for the Air Force—studying processing with a new series of resins that apply as easily as water to heating plates, that resistively cure at room temperature, and withstand exposure to temperatures of 800-900°F.



HYDROCARBON FUEL SYNTHESIS
AND EVALUATION...

screening compounds for improved jet fuels. Under Air Force contract, some exotic and highly promising fuel candidates have been prepared, including compounds with silyl ether, silyl ether, ether, and cyanoethyl groups. Some unusual candidate compounds have been prepared include:



5,5-dimethyl-4,6-methenopyr[2,5]olane

8-iodobutyltricyclo[4.2.2.0^{1,4}]decane

disipa[5.0.5.1]tridecane

4,4,6,6,10,10,12,12-octamethyltricyclo-
[7.3.0.0^{2,7}]dodecane

HIGH-TEMPERATURE LUBRICANT ADJUTIVES...

for the Air Force—to provide extreme-pressure properties, post-cure modification, viscosity-grades improvement, and oxidative resistance to synthetic lubricants that must operate in the temperature range of 600-800°F.



For further details on Moss-
son's capabilities in the field
of special materials develop-
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This simple apparatus was developed by Atomanto in collaboration with the NADD Metabolic Laboratory. In its simple refined form, it is essentially a modified Bodenshiel gauge and is used to measure accurately the thermal stability of as little as 0.2 grams of lipid or solid up to about 1600°C.

In addition to the foregoing, Massimo scientists are studying the chemistry of semiconductors, micro-metallic oxides, electrochromisms, fuel cells, molecular separation of helium, intramolecular thermocouples, radiation-resistant coatings and heat-transfer fluids.

SPECIAL MATERIALS FOR SPACE-AGE ENGINEERING... a chemical instability of Monocote

Supersonic vehicles, guidance systems, satellites, data-transmission systems, solar towers, early-warning networks—their rapid evolution has overruled the performance of coating materials. New materials—of every kind—are urgently needed. These new materials start from new molecules, and Monsanto research chemists, whose professional reason d'être is creating new molecules, can help other scientists whose major concerns are the finished items—not the stuff of which they are made or the numerous and complex "joists" essential for space-age hardware operations.

Monsanto's knowledge of synthesis of materials is a valuable adjunct available to specialists in many fields of advanced engineering. When your project requires a material with special properties, you are invited to discuss your needs with Monsanto. Write or call **MONSANTO CHEMICAL COMPANY, Department AV-1, C Building, St. Louis 85, Missouri.**



Beech B95A Travel Air's Base Price Is \$49,500

Boeck Aircraft Corp.'s new Travel Air has a base list price of \$49,900. Powerplants are 150-hp Lycoming IO 540-B1A fuel-injection engines, cruise speed at 75% power is 200 mph. Maximum speed is 218 mph. Range with reserves, based on 195 mph, at 65% power, is 1,091 mi. Gross weight is 4,200 lb., empty weight 2,515 lb., useful load 1,645 lb. Place seats up to five people.

control is planned. Radar will be an X-band 18-in. sensor, with a five-inch scope on the mast.

All-weather systems will include electrically energized rubber boots on wings and tail, with engine air used to keep them free from ice. The C-130

Electron capture is provided by a δ c supplemented with 115, 402 and 4 c to handle the amino acids, side-chain nitrogen and carboxylate groups, and the carboxylate. The δ c and δ c systems are independent. Hydrophobic nature allows Shalini to open/split heads, with normal amino acids, of 1,150–1,800 aa.

Light control system is a completely over-riding mechanical type, with no boost system employed. Connections from saddle pins and control columns to the surfaces is via push-pull motion, bellows, pulley and cable system.

There is a 30-in. x 26-in. luggage compartment door in the lower face bag behind the cabin. Arms is unaccommodated, but Arms Commander is studying accommodation in the near future; there is a demand for it. There is also

an access door in the bottom of the air handling, behind the baggage compartment area, measuring 21-in x 9-in. ground

Leading gear has been fitted on the nose gear, single wheels on contriflex struts on the main gear. A

Older strains have a maximum operating level of 8 m. Nine gas wheels and hoses are 18 in. x 44 in. and can be power stowed through 45 deg. each side of center. Wheels retract off. Miss gas, consisting of 24 in. x 77 in. Goodwin wheels, tires and baskets are the same wheels and baskets used on the Grumman Malibu. Landing gear struts are by Skatrol.

MS-880 Production Rate to Be Doubled

Pump—Contracted sales increase of Matsuo Seiki's all-metal M15.580 Bailey, has led the French builder to double planned production rate.

Company expects to reach a monthly production rate of 70 this summer and to double that rate by March of next year.

To date, company has received 311 firm orders for its three-place sports plane. Cessna Aircraft Corp., Van Nuys, Mich., plans to assemble the Balke in the U.S. (AW May 20 '81, p. 46)

Single-cage Rafter is offered in three preweld versions ranging from 90 to 245 hp. Continental engines.

U-8 price ranges from \$5.750 for the 90-hp variant to \$7.095 for the 140-hp version. Loatic, designed MS-85, has just begun its test flights. MS-85's prototype will be shipped to U-8 for demonstration on May 15.

Beech 1961 Military Business Declines

Sharp ending off its initial business as reflected in Bosch Australia Corp's first six months' annual report which notes total sales of \$46,799,770 for this period of the company's fiscal 1981 year compared with \$52,199,150 for the same period last year. Net earnings after taxes for the six months period totaled \$1,912,206 compared with \$2,494,545 for the same period in fiscal 1980.

the 1980s, evidence for the first six months of fiscal 1981 was that corporate 1980 losses as percentages of sales were, \$13.999-49.68 (\$39.215-81.01) and business current sales, \$23.200-231 (\$27.901-132). Indications that our sample industries occurred in the U.S. industrial economy applied were leading to business current sales despite increased sales efforts were evident in the company's conservative statement that "our complete line of flexible business plans are finding a steady market," rather than the "uncertainty" of the major percentage increases that have been common in this area over the past year.

The company declared its regular 15 cents quarterly dividend for each of the 2,700,011 shares outstanding, payable May 5 to holders of record on Apr. 21.

Skywagon Designed for Multiple Missions

By Andy Kol

Cessna Aircraft Co.'s combination of a 200-hp fuel-injected engine on 86 in. constant speed propeller and its all new spacious interior gives its 185 Skywagon the usefulness potential in which it was designed.

Powered by the Continental IO-470F engine, Cessna's latest all metal high wing aircraft comes as adults and 270 lb. of baggage with full standard fuel of 45 gal. at speeds up to 170 mph. Equipped with foam, the Skywagons will carry five adults and full standard fuel up to 150 mph.

Attachment of a V-16, 9 ft. x 51 in. plastic pad in the underside of the fuselage affords an additional 12.5 cu. ft. of storage area with a possible of less

than 6 cu. ft. and an allowance in take off and landing configurations.

The Skywagons, priced at \$18,990, because at the factory is similar in configuration to the Cessna 180 with the exception of the steel window which gives the fuselage a larger appearance and provides stability for the passengers in the third row of seats.

Wing-cowled propeller shows the propeller dimensions to be 25 ft. 4 in. from propeller hub to tail wheel, which extends 4 ft. forward from the middle. Wing span is 34 ft., dihedral span 10 ft. 10 in. with the middle mounting to a height of 7 ft. 9 in. Height of aircraft floor at cabin entrance is 33 in. with inside distance to baggage compartment 26 in. above the ground. Wheel span is 7 ft. 8 in.



SKYWAGON will also be certified for fuel plane operations only at 150 in. with engine-powered and performance requirements. Equipped with the aircraft is shown operating in the cross air tip.

Model form was a drop-in design, proven under engine, propeller, gear, engine, and fuel, rate of climb or outside temperature instruments. Engine weight of this particular aircraft with engine, fuel, and oil, was 1,610 lb., grossing out to 2,410 lb. on the maximum weight. Serial number N88108, it was the 21st production model off the Skywagon line with a total of 1579 flying hours accumulated.

Entry to the aircraft is on either right or left cabin door which are 37 in. wide and 41 in. high at three maximum dimensions. The right cabin door has removable steps and a detachable door step permitting the aircraft to be loaded.

Sitting pilot and copilot seats, built-in entrance to the second row of seats. The back end of the cabin seats can be folded forward in response to gas access to the rear double seat. Five different loading configurations are possible within the spacious cabin at all but the pilot's seat are easily removable.

The cabin is roomy and comfortable with no restriction in individual movement. Excellent views are provided by large windshield and side windows. A large baggage trailer on the right side and ground installation. Two ventilators are in each upper corner of the windshield and two additional full and socket ventilators provide additional cabin ventilation when release.

Instrument panel follows the standard Cessna policy of grouping flight and navigation instruments on the left hand panel with radio equipment, standard gauges, and fuel flow gauge in center panel. Right-hand panel contains gauges for additional radio navigation equipment and engine instruments.

Forward throttle, propeller and mixture controls positioned below the center panel along with the fuel flow gauge which is to the extreme right of the center panel.

Fuel Pump Taggle

Accessory electric fuel pump, right, cabin fuel control and generator occupy a space above the throttle and propeller controls with the master switch, combination master/generator and auxiliary switches covering the lower panel along with the master battery.

Recommended 180-150 actual fuel is located in two tanks, one in each wing, holding 12.5 gal. each. Total



SKYWAGON is powered by 200 hp. Continental IO-470F engine and cruises up to 170 mph with a full load.

usable fuel of 51 gal. each a gravity feed from tanks in front and rear bottom of tank tank to a fuel accumulator tank. Then from each tank is used barometer equipped with an over-pressure warning. A gas shutoff valve and fuel shutoff is inserted between the fuel accumulator tank and carburetor fuel pump, by passing two electric fuel pumps, when they are not operating. The gas shutoff fuel from the fuel pump flows through a fuel control unit to a distributor manifold which disperses the fuel to a fuel nozzle on each engine cylinder.

Valves and valves fuel from the engine driven fuel pump and fuel control unit are returned to the main fuel tanks by use of a super speedometer vacuumator tank.

The fuel flow and mixing the appropriate mixture per hour of fuel being returned to the engine or not, is used to mix the mixture, by the fuel pump. The mixture has two main settings as in low fuel pressure and high fuel pressure. The mixture and fuel flow are controlled by the throttle and fuel flow gauge. The mixture and fuel flow are controlled by the throttle and fuel flow gauge. The mixture and fuel flow are controlled by the throttle and fuel flow gauge.

Turning the combination starting motor on in the short position sets the right mixture supplying a driver at high voltage, reduced speed, free a starting vehicle and in comparison with the left mixture. The Continental fuel-injected engine, fuel, and mixture and pressure is reduced on the starting fuel, which returned it to

the "rich" position providing dual mixture for better engine acceleration.

A standard fuel and oil control is mounted with full electric and open of 2427 with a slight degree of redness arrival to increase heat in the Skywagons started in barrel full.

Short Takeoff Roll

With an indication of 65 mph, back pressure was applied to the control rod with a ground roll of approximately 320 ft. When normal climb speed of 110 mph was established, power was reduced to 2400 and 2,450 rpm, mixture was leaned to 15 psi, fuel flow, fuel flow was opened to one-half and a climb to 4,000 ft. was accomplished.

With the needs, fuel and gas consumption instruments, climb, turn and landing were maintained in the same manner. However the stability of the Skywagon was such to allow

hands-off flying in climb, descent, turn and straight and level with adjustment of throttle, elevator and ailerons.

At 4,800 ft. with cruise, power setting of 23 in. and 2,400 rpm (5571) and mixture, leaned to 12 psi, gph, the indicated speed was 160 mph.

Reducing a manifold pressure to 12 in. and full rich mixture, aircraft descends in steep turn to full throttle and level. At an indicated speed of 70 mph, altitude and mixture controls were positive and firm without abrupt response.

During the power completely the mixture was held in the straight and level attitude until it stalled at the speed of 45 mph. As the aircraft approached 35 mph, the turning, turn, mixture, mixture in pitch and yawing as it approached the stall speed. The stall was clean and gentle without a wing dropping tendency. The nose fell



PLASTIC PDB, 9 ft. x 51 in. and weighing 77 lb., provides extra 12.5 cu. ft. of storage area with a possible of less than 6 cu. ft. and no change in takeoff or landing configuration.



Black, supersonic T-38 will train USAF pilots in the rigors of space-age flight

T-38 Supersonic Trainer Enters Service; Will School USAF Pilots by Year's End

RANDOLPH AFB, Tex.—A new era in supersonic flight training began in mid-March here with delivery of the Air Force's first operational T-38.

The two-engine Mustang jet, the new test pilot prior to entering full-fledged service as a "supersonic classroom" for space age pilots. The T-38 will provide new dimensions in safety and versatility to pilots training in the art of supersonic flight.

According to Air Training Command schedules, the aircraft will be used for instructor demonstration and checkout here until early fall. Then it will move to Wright AFB, Tenn., and fully operational training status.

The T-38 "Falcon"—powered by two General Electric J65-D turbojets—is the world's first supersonic aircraft designed expressly for training purposes. It combines performance capabilities of jet fighters twice its size with the high-

est safety assurance of any aircraft in its performance class.

The new trainer has Mach 1.5 speed capabilities, and a maximum rate-of-climb of 26,000 fpm. A single-engine counterpart of the T-38, Northrop's M-150F "Falcon Fighter," has somewhat greater performance capabilities.

See the J65 engine at the Paris Air Show



Model 240 Marine Turboshaft on Test

CINCINNATI, Ohio.—General Electric's Model 240 turboshaft engine is now undergoing qualification test prior to application on the U.S. Marine Administration's 80-ton, 60-horsepower craft scheduled for sea trials this summer. The engine is part of a marine power package offered by G.E. that includes powerplant, transmission, and docking engine.

A modified turbo-shaft version of General Electric's proven CJ955 commercial turboshaft, the base Model 240 engine weighs 8600 pounds, only one-third as much as similarly rated reciprocating engines and some propulsion systems. Its compact size makes it suitable for deployment under pro-

Vertol Copter Selected as US Marine Transport

WASHINGTON, D. C.—A military version of the Boeing Vertol 107 helicopter-powered helicopter has been selected as a main transport for the U.S. Marine Corps.

Like the 107-II, the military Vertol craft will be powered by two General Electric T58-6 gas turbine engines.

The Vertol 107 prototype design originated as a 1700 hp turboprop. Two of these ships have been ordered to 2350 hp and are now undergoing FAA performance tests. The 23-passenger commercial 107-II will enter service this year with New York Airways.

Primary mission in the Marine Corps version will be power-operated hoisting, making the transport adaptable to the limited elevator and longer dimensions of Navy assault ships. It will be fitted with 26 seats, and will handle payload loads over 5000 lb.

The G-E T58 engine, which will provide the turboprop with 130 mph cruising speed and 345 mph top speed, has already proven its reliability in over 50,000 hours of operation.

G-E T58 engines also power the U.S. Navy's Sikorsky HH-53 helicopter and its commercial version the S-64, known as the FAA certified Sikorsky S-64.

See the T58 engine at the Paris Air Show



End of the 257th test mission, the F-104/279 has 500 hours without major overhaul

F-104 ACHIEVES 500 FLIGHT HOURS WITHOUT MAJOR ENGINE OVERHAUL

TINKER AFB, Calif.—The Lockheed F-104/279 weapon system has shown that it can achieve 500 flight hours without a major engine overhaul.

Capability of the "Burrhead" J75-C17 engine to reach the 500-hour mark was proven by a USAF accelerated service test mission terminated during March, 1961.

The program was conducted over a seven-month period and involved 357 typical Tactical Air Command missions. It was jointly conducted by the U.S. Air Force's Oklahoma City Air Materiel Area Maintenance Division, and the General Electric Company.

See the J75 engine at the Paris Air Show

General Electric's proposed flight research program will continue later parts of basic life development and research. A J65-powered lift-lift engine has already completed over 100 hours of successful test-bed and field target missions.

In the U.S. Air Force and the Air National Guard, F-104/279 effectiveness has been measured by duty cycle factor than 54 percent of over 35,000 flight hours have reported trouble-free. The J75 engine of the Mach 2 fighter produces nearly 10,000 pounds of thrust, yet weighs less than 3500 pounds. It has powered the F-104 to eight world speed-to-height records, and the world altitude record of 103,305 feet.

See the J75 engine at the Paris Air Show

VTOL Flight by 1963 Slated for G-E Lift Fan

CINCINNATI, Ohio.—First flight test of a lift-fan powered VTOL aircraft is planned for 1963 by G-E's Flight Propulsion Laboratory, Dayton, Ohio.

The G-E liftable is based on a proposed flight research test area demonstrating capabilities of the company's J65-powered lift fan aircraft of the future. Estimates are that a lift-fan powered jet aircraft will be airborne 21 months after start of the program.

Under the proposed G-E plan, an experimental aircraft will be equipped with two water-cooled lift fans powered by J65 engines bolted in the fuselage. Engine thrust will power the fan during takeoff and landing, and will be converted to jet thrust for horizontal flight.

An important VTOL safety factor will be incorporated by transmitting each engine's thrust so that when one engine is delivered to such as with this arrangement, 91 percent of the aircraft's design lift can be retained in the event of an engine failure.

General Electric's proposed flight research program will continue later parts of basic life development and research. A J65-powered lift-lift engine has already completed over 100 hours of successful test-bed and field target missions.

See the General Electric lift-fan display at the Paris Air Show



The lift fan took time of several airshows considered by G-E for VTOL testing

See These Engines—and Others—at the Paris Air Show . . .

On display at G-E's Paris Air Show exhibit will be: Left, the J75-C17 engine—developed and built by General Electric's Flight Propulsion Laboratory, Dayton, Ohio, and built by the Air Force's F-104 and G-38, and the Navy's A-1 and F-41 in 18 world flight records; Center, the J65, recently modified to pro-

vide an unparallel 10-to-1 power ratio, and Right, the CJ955-23 turbo-prop, currently powering the Carrier 870 and Carrier 871. Other on display include the CM58, and QF900 commercial powerplants, and the T58 and T44 turboshaft engines.



FLIGHT PROPULSION DIVISION

GENERAL ELECTRIC

2905 MPH HIT BX X-15; TOP MANNED SPEED MARK

KIRKPATRICK AFB, Calif.—The X-15 rocket plane attained its new manned flight speed mark of 2905 mph on March 10 here.

The experimental aircraft, whose mission is to carry 4 to the fringes of space at speeds up to 4500 mph, made its run at 73,000 feet.

Power for the X-15's electrical and hydraulic systems was supplied by two General Electric auxiliary power units, unique turbo-shafts that operate independently of the aircraft's rocket engine. The hydraulic powerplant powered APC's main aircraft control and pilot safety.

See General Electric's constant speed shafts at the Paris Air Show.

pulsion, and use as a mobile alternate power unit.

Besides size and weight advantages, the Model 240 is expected to offer suitable benefits in maintenance simplicity. The G-E powerplant consists of a CJ905 turboshaft engine coupled aerodynamically to a specially designed power turbine that converts jet thrust to turboshaft horsepower.

High speed hydraulic systems are expected to play an important role in the future of marine transportation. Planned future versions will carry hundreds of horsepower at 9000 rpm.

See the Model 240 engine at the Paris Air Show

New Avionic Offerings Spur Investments

(The clippers, primarily manufactured black boxes to increase the speed of cut-off.)

With increasing competition for the business, sales with profits became more and more difficult. We made a decision. We decided:

- That military hardware was hard to steal for a long, long time
- The over-all dollar market in the military would continue to grow
- That the only base on which we could hope to expand in the military would be to expand our technical areas
- That to attain this would require establishing substantial research and development abilities
- That we would use research and development as the means of securing

(A research and development contract already had been let to another company for such a system, but Local was able to suppress the Navy efforts to win a separate evaluation of both units.)

The new result—our first turn-out contract exceeding \$10 million and strong notice that Loos was capable of advanced research and development in spite of a limited technical staff. The substantial award made possible the beginning of this expansion of our engineering department and our research and development efforts and has placed us in our present prime position for production contracts of equipment and systems researched and developed by us.

We have taken every business advantage of that credit. On a constantly expanding basis we have added to the numbers and the technical scope of our engineering department. From a 1956 total of 94 people, on Mar. 1, 1961 we had 791 in this department.

Following its 1956 analysis, Loom used its first system contract to gain competence in other specialized technical areas, recognizing that company reputation ability to perform, and top-notch specifications all were essential in products to win further business.

The company is now divided into divisions for technological areas: Ausbrennerei, Werker, Brennstoffe, Countermeasures Division, Duplex, Plaster Division, Music Technology Division, which includes practising arts and music, different systems, Navigational Computer Division, Passive Detection Division and Reconnaissance Division. Some of its other products include the AN/ASB-21 integrated airborne ASW data processing system, AN/APR-9 countermeasures receiver, AN/ALQ-78 ECM system and the AN/ALQ-73 passive detection system.

Where previously Loral handled all sales and leases from its New York office, today it has offices in Washington, Dayton, Glens, and Tempe, Calif. From each of these centers we have networks or adjacent important centers of defense activities. On a daily basis, we have field engineers, sales people and research and development specialists in constant personal contact with the engineering, the development, the planning, the tactical and the prob-

Our first efforts were with the machine. With limitations in capital, facilities, and technical personnel, we were attracted to the area of plastic competition—namely, open bed rooming.

For Kline and following advice of the new Eisenhower Administration, Secretary of Defense Wilson was faced with a serious problem. He found continued inventory additions with increasing expenditures of depleted resources. He was told that "except for 'surplus' he ordered the halt to inventory additions wherever possible. As a result, our backlog suffered in 1955. This resulted in a drop in sales for us and the industry in 1956, but we still showed a good profit. In 1957 we moved into a good sales year. During each of these years we showed good profits. In no year since our entrance did we show a loss.

One person who has been experienced enough to review our sales philosophy. Prior to that time practically all of our business was under open bid contract against stiff competition.

We were obliged to establish the beginning of what we called our "C-2" (intelligence gathering) operations. We spent a great deal of time at our government agencies, we looked for equipment that would be the best equipment of importance to us, and we took notes. In the interests of brevity, let me mention that we found a "hole". We allocated a quarter of a million dollars to buy a limited number of sets and a number of computers, and the sets and developments came up with our NSA 15-a new dropper, dead end, using artificial satellites, computer, computer equipment, and more accurate equipment. We found that the fifth of the equipment it sought to replace. It was basically the first time we had a system to replace the most advanced equipment which had been

(Last) built a prototype of the system in its 5173-000 garage and took it to the potential customer, Navy's Bureau of Aeronautics.



The Douglas Thor rocket has orbited more satellites than all other rockets combined!

Of all missiles put in orbit since 1958, 80% were launched by the Air Force-NASA Thor IRBM. In its last 83 tactical and space flights by the Air Force, Navy and NASA, 80% have been completely successful—a reliability inherited from forty years of Douglas experience in aviation and 21 years in missiles and space.

DOUGLAS

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SPECIAL SUPPORT EQUIPMENT • AIRCRAFT • AERIAL DEVICES

in areas of the Defense Department. Where previously we had one base customer, namely, Navy Bureau of Aeronautics, today we cover practically every Bureau in the Defense Department including all areas of the Navy, the Air Force, the Army, the Marine Corps and the independent agencies, i.e., National Aeronautics and Space Administration, Federal Aeronautics Agency and others.

Daily Reports

Our G-2 daily reports from all known contacts are furnished into our home office.

[illegible]

All that has been accomplished since 1945—and I believe the additional statistics it furnishes will speak for the results.

In 1956 we employed 450. On Mar 1, 1963, we employed 2,312.

In Fiscal 1960 our sales and profits more than doubled 1959, namely—from 57,046,800 sales and 5131,348 net profits, to 517,439,000 in sales and 5575,236-net profits. I suspect that for Fiscal 1961, ended Mar '61, we will again more than double sales and net profits over Fiscal 1960.

To complement the use of the known modern tool under guidance of an experienced industrial engineering department. This includes constantly revised organizational charting with job descriptions and detailed back-up computer-aided practice research, sales engineering, data processing adapted for every possible activity, including total wage controls of all contracts, and preparation of award contracts. All internal activities for maintenance of one efficiency, all equipment handling attributes and administrative procedures are planned and controlled by flow.

Prior is going public in 1998. Louis says 100% certain. As a public com-

ports, it became possible to discuss
into non-military areas.

In line with our philosophy of acting only after study of all available facts, we organized a new Acquisitions Planning Group which proceeded to complete a study of every active area constituting the electronics industry. This comprised at least 186 diversified areas. None of you have heard of Loral's Product Planning "Table." A careful and thorough analysis was made of each and every one of these areas. The project took us months.

Technical and business committees were organized. Long hours were spent in review. A system of nothing was established. This included consideration of industry background, market and distribution problems; competition; special product considerations; depth of engineering and manufacturing problems and fixed and business considerations.

In addition, general crises were established which included consideration of potential profit margins, growth potential, volume and scope of the market consideration of whether the products served an industrial market rather than a consumer or retail market the need for the products (e.g. sufficient and positive and unobscured sales channel, entry investment requirements etc. In addition, consideration was afforded for effect under various political conditions, i.e. various states of war, and state of peace.

Slow but Consistent

We haven't moved much, but we have moved carefully. To date, we have made two acquisitions: Alpha Wire Corp., and Hillborn Electronics Corp.

Let's look at the Alpha acquisition. We paid \$100 million, reasonable price. We acquired a company in business for 39 years. Highest sales price paid in acquisition: \$100 million. Alpha was recognized in the industry as No. 2 in truck, broad acceptance. It had 2,128 accounts and a proven sales distribution setup. This sales distribution setup is available for other buyers paid up-and is already known and used

Alphas had approximately 4,000 items in its catalog. It had a high reputation for quality and service. Promptly answering Alpha's request, we prepared a thorough four-volume equipment plan. We have been adhering to that plan. Among other things, since acquisition among new items has been added to their list. These include a full line of irrefutable and costly communications and security gear for power and communications equipment, a line of shielding and bonding gear, a line of ground and shielding equipment, a line of ground reference gear, additional lines of modern wire and cable, a full line of TV, radar and

cible for the distributors' market and other areas. The West Coast plant which had been opened at about the time of acquisition has been expanded to perform full manufacturing and warehousing functions and is now serving 11 western states. A market research department has been organized. We entered into a joint venture with a laboratory outstanding in the field of radiation applications to develop irradiated polyethylene wax and cable.

Alpha is doing things on a planned basis to build up its volume. Sales during our first year of operation will show an increase of approximately 40%. The total wire market is sizable, i.e., \$700 million.

A business about Billham Electronics Corp. For a mutual stock consideration, we acquired a small company. It had developed a complete line of high quality industrial films with complete production tooling. Sales agreements, we have put together a team which has cataloged the line, prepared new packaging designs, established a complete advertising and distribution program and a sales organization, including utilization of the distribution facilities of Alpha Tech.

Our products have been demonstrated. They agree with our industrial salesmen's plan. We already are receiving orders. Sales Billham is participating in a total sales market of \$187 million.

We have looked at some potential acquisitions during the past year. We could have completed acquisition deals with some of the companies which we looked at. We are not interested in making acquisitions for a few points in the market. It is our firm policy to make an acquisition unless it will be solid and will add to our current and future. We will not selfishly risk profits or future earnings. We seek the reverse. We will never be gluttons for glimmers of light. We look for solid growth and have a lot of it. At the time, however, we are looking at a number of interesting situations. One of them is (anonymous client).

We are presently 35% military. We would like to attain a 40-45 status. We shall stand on this decision.

Statistics accumulated for the nine months ending Dec. 31, 1960

Company Key Data	1971	1970
Current assets	\$1,414,000	\$1,187,000
Current liabilities	751,000	773,000
Net assets	279,000	149,000
Net income before taxes		
Income	\$10,000	\$75,000
Net income per share	\$4.75	\$7.50
Current assets in new and old divisions	50	50
Turnover of working capital	2.5 times	2.0 times
Turnover of tangible net worth	3.0 times	2.0 times
Net assets to tangible assets	1.00	1.00



First Street I.E. began in Lockman Valley complex at Edwards Rocket Site. C&D will cost 1.5 million to P.E. rocket region.

The 515-million Leontine Ridge test ranges for the NASA Rockhopper F-1 liquid-propelled rocket engine is nearing completion. A Edwards Rocket Site Club. Terms of the complete F-1 propulsion system will begin under this contract on Test Stand 1A, which was completed in December. Test Stand 1-B, depicted on this page, is the largest on the complex and the last to be completed. It will be used in maximum thrust tests of the F-1. Stand 1-B is 150 ft tall, uses approximately two of the bar code

gases and can be expanded to handle loads as required. A 75,000-gal. vacuum-pulverized liquid oxygen tank and a 60,000-gal. single-walled test tank are located on top of the stand (SW Max 27 x 63). The U-1 is being developed by Rockwell's Division of North American Aviation under a contract from the National Aeronautics and Space Administration's Marshall Space Flight Center. A pressure-fed U-1 chamber on Test Stand 2-03 has achieved a thrust record of 1,610,000 lb.

Tests of Complete F-1 Rocket to Begin Early This Summer

Waterproof floor deflector is heavily rusted, worn on Tilt Stand 1 & 2. The #1 resources modified at rate of three hours/stand.



Major Staff Expansion Now Underway at RCA BURLINGTON, MASS.

Vital projects such as SAINT, TIMEWS, and AICM Radar Techniques are underway at RCA Burlington, one of New England's newest electronics laboratories. These projects call for men of exceptional creative ability whose primary objective is a sense of accomplishment. Salaries are scaled high. And advancement opportunities are excellent.

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Guidance Systems	Propulsion
Trajectory Analysis	Radar
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Infrared Systems	Computer Design
Radar Systems	Intercommunication
Scintille Systems	Computer Programming
Control	Automation
Circuit Design	Space Systems

For further information and to arrange an interview with engineering management, contact:

Mr. John P. Clancy, HR-1000
Radio Corporation of America, Dept. U-66
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MANAGEMENT

Aerospace Investment Abroad: Part III

Mutual Aid Program Spurs U.S. Industry

By Cyril Bowdler

Geared-European manufacturers of U.S. hardware, whether under straight license agreement, by a technology or by an affiliated firm, often goes far beyond the relatively narrow production by contract to help prove the principle of unique aspects of the U.S. aerospace industry.

Orders for actual weapons systems in the mutual build-up phase when final production plans cannot meet immediate weapons needs by a particular country, orders for components, spares, tools, and test, testing, etc. all plus their part in proving fresh look into the U.S. economy.

This trade from its obvious political and military role is one of the major predicaments offered by U.S. officials closely connected with the mutual aid program both in Washington and in Europe.

Mutual aid programs at their best have triggered major component orders within the U.S. and, conversely, spurred production beyond production

of European-developed hardware by domestic American firms. A volume U.S. effort in France and Italy, that alone are one mutual aid program—as opposed to outright military assistance grants—will lead to much more business than are passing as an aid. The balance of payments will greatly wind up with a plan on our side.

An outstanding example of the benefits that can come from such aid—and from foreign production in particular—is the Lockheed F-104 defense program at its own state, where a mutual aid investment of approximately \$230 million promises an overall return of about \$1 billion in U.S. business.

The U.S. government, at a year to induce Belgium, The Netherlands and Italy to join West Germany in the European F-104 production program and maintain their forces at the same time, set aside an aid of \$140 million for the three countries. Another \$50 million is added for Japan and its purchase production plans for approximately 200 aircraft.

Total expenditures in the foreign

production program for the F-104 is now established—\$450 in Europe, \$100 in Canada for the Royal Canadian Air Force, and \$20 in Japan—is estimated by Lockheed at about \$2.54 billion. \$1.150 billion in Germany alone with 624 of the European aircraft plus 126 purchased directly from the U.S. About half of this total will be spent in the U.S. and, but for mutual aid incentives, some of the countries might not have joined in.

The figures do not include any U.S. production that was, in fact, necessary to provide several nations including Greece, Turkey and Mexico, with the F-104 in 1959 or as part of the response. Although private production of these aircraft was up to Canada (AW Apr. 28 p. 27), the U.S. industry should still salvage major new product orders.

Mutual aid funds also have played their part in spawning European common production for the Sidewinder and Hawk missile programs both of which will need support from U.S. supplies although probably not as a rule.



Liquid Air Cycle Engine Demonstrated

Liquid air cycle engine being developed by Moog Corp. is demonstrated at the company's Shop, Cold Air facility. Liquid air is being used in an engine in an 18-in. diameter chamber. Moog is working on several methods of liquefying air from the atmosphere to be used in an engine for Aerospace Plane in flight inside the atmosphere.

approaching that of the F-86 program. Production agreements with an industrial firm or countries made outside the veil of secret aid and/or the North Atlantic Treaty Organization also can make an impact, including some that strengthen other links abroad beyond the actual flow of cash.

Germany's Westinghouse, for example, is rushing to build two prototypes of the Skybolt S-64 Flying Crane II as expected, stable German order for the S-64 follows. United States will gain considerably through the supply of components, probably including Pratt & Whitney JT-1D-12A1 gas turbines, directly from the U.S. Profits from these items should exceed by far the loss and stock dividends United stands to realize from the program. The American firm holds more than 40% of West's outstanding stock.

Even the much-debated Breguet 1170 Atlantic reconnaissance satellite patrol plane program, a NATO-sponsored project involving U.S. nuclear weapons development funds, promises returns to the U.S.

Although at the time, Atlantic was chosen over U.S. defense companies, contractors that thus were excluded from net of the competition in order to avoid a European victory over U.S. firms will stand to profit by sales, identification and detection



Aerojet Fires 350,000 lb. Solid Fuel Engine

Aerojet-General Corp. 65 in. dia. solid fuel experimental engine, built to be fabricated and fired under Air Force Large Solid Rocket Motor Program, started over \$60,000 lb. of thrust. Test stand was designed for the program.

equipment for test sites, is being ordered in large part from the U.S. and again, overall, net returns covered — some of the returns seen in the program might not have come in had the Breguet become a Mach 3 U.S. design.

Material aid participation also gives the American government a window into

domestic rights to the Breguet, and it may yet be profited in the U.S. if the Navy decides to order it in quantity for its own use.

The NATO-ASW competition, however, highlights a sobering fact with which the U.S. industry must contend in an increasing scale, particularly in the European industry against a more

equal footing on the technological levels.

A high-ranking Navy officer in Washington, who has followed the program from its inception, declares that "costs plants that American firms were losers out just isn't true. Cost out there out. We can get the products we need in Europe at a third of the price it would cost us here."

Mr. Gen. C. Sherten Ruback, head of the U.S. Mutual Weapons Development Team (MWDT) headquartered in Paris, agrees. Even so, research and development work, Ruback says, "we generally can get what we need for about a third of what it would cost us in the U.S."

Ruback cites as an example the Newsgroup Torus III anti-submarine weapon system developed with the help of "very little" mutual weapons development funds. The Torus now is being produced by open-market evaluation should Newsgroup and U.S. carriers, then, III or later up to its present. American manufacturers probably will be called upon to produce it in quantity for the Navy.

The Fiat G-91 lightweight close-support fighter provides another example. After its selection in NATO as a common fighter, mutual weapons money was paid to support production of the first four prototypes. The aid in all such agreements earned with it respect rights for the U.S. government to manufacture, it is America without fire it wanted to do so.

Versions of the Italian aircraft are now being evaluated in the U.S. by both the Army and the Air Force. Should either decide on substantial aid, U.S. manufacturers will reap the benefits.

This reverse flow of hardware from Europe to the U.S. is the other side of the coin of the mutual aid programs that are producing increased low-level and increased profit potential into the European industry as well.

It is a fact, however, that does not always please all the participants, not just in evaluating, as in the case of the Nord SS-11 anti-tank weapon system.

An improved version of the SS-10 dc, developed in part with mutual weapons funding, the SS-11 can be produced at a cost of well under \$2,000 "second cost" in MWDT.

This program, "a mutual aid effort in Washington area," is another example of sending over a little and getting a lot back in return.

We spent less than \$5 million on the [development of the] SS-11 compared with \$18 million invested in the [Manned] Dert before it was scrubbed when no de-allocated another \$25 million.

"The SS-11 has less capability than the Dert, which had live and cold red-

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4. **LUNAR EXPLORATION**—Lunar analysis of the composition of the moon's surface. Beckman has a probe to study for JPL, a Beckman double-beam absorption spectrophotometer will utilize a tracking solar furnace for sample examination.

5. **BIOMONITORING**—Beckman helps to develop human functions by electronic means through the use of miniature lead attached electrodes components.

6. **ENVIRONMENT DETECTION**—Beckman's advanced transmission checks for the presence of hydrocarbons in gas or liquids. Electrode hydrogen gas detectors monitor carbon for the environment.

7. **ON-BOARD MONITORING**—Beckman's advanced portable sensors are being used in space vehicles like space, a space exploration studies and a space station with portable and its research.

8. **REMOTE SENSING DATA PROCESSING**—Beckman has indicated the application of a multi frequency multiplexing system from remote for handling satellite data.

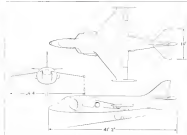
9. **REMOTE PROPRIETARY ANALYSIS**—Beckman's advanced multiplexing system will monitor and process data in remote nuclear stream.

To get-and-knowing to the Beckman Mark II Analyzer was developed by and is now licensed to a number of major research institutions. It is used to analyze the air. Beckman engineers have been studying the air. Beckman's research and development is to be used to analyze the air. Beckman's research and development is to be used to analyze the air. Beckman's research and development is to be used to analyze the air.

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BRISTOL SIDDELEY RS 33 turbojet engine powering the Blackbird F-1127 single seat V-1000 aircraft (shown) has had \$2.5 million approved as U.S. funds. In addition to powering the P-1127 NATO order, the 15,000 lb. thrust engine will power a Fokker Republic Avionics computer (AM Apr. 24, p. 30)

wing which has to be the jet, and it's a lot less complicated."

The final result of the jet engine of course, the Mach 2.0, but a contract, and production begins. It might otherwise have been a different problem, selected to produce the RS-33 in quantity for the Avionics, given an order it would not otherwise have had.

Another program in which mutual weapons development funds have been spent that could and some segments of the U.S. military to the possible detriment of others is the Bristol Siddeley RS-33, now powering the Blackbird P-1127 V-1000 design. The U.S. has been made the decision to approximately \$2.5 million to the RS-33 project "in order to let it go," according to a Pentagon official.

"NATO wants a V-1000 for close support and we need a powerplant to put in it," he adds. "That's nothing like comparable to the RS-33 and that's how we began to get on that track. And a few fractions of the money has been spent in the U.S. NASA has done quite a bit of work, being it into the U.S. in comparison."

The RS-33 is stipulated for two of the engines in the current NATO competition for a V-1000, close-support fighter—a P-1127 follows and a design developed by Fokker with Republic Avionics Corp. and British Aircraft Corp. and it quickly orders follow. "The new world's most advanced of the RS-33 production," the official says.

"We have the same engine in the host government and if we don't, we don't put the money into it. If we want to

produce the RS-33 for the military, we have the same engine as the British government, but we don't have the right to produce it for commercial purposes. If we wanted to put it into a delivery that would be a different problem."

As to the mutual weapons development program as a whole and its relation to the overall dollar flow, the Pentagon official estimates that "over 90% of the total has been spent on the U.S. and I don't think it's likely it's been reached." The total V-1000 budget has averaged between \$35 million and \$40 million since its inception seven years ago.

A same budget span to the ratio to the overall flow of the possible profits has been the government's Export-Import Bank of Washington which has helped finance an estimated 35% of all U.S. exports sold abroad since 1947.

Total Export-Import Bank revenue on such loans had reached \$328,717,337 by the end of 1980 as raised value at \$576,997,992 and along the value of approximately 20 different nations. As an example of the scope of the bank's activity, before equipment loans have included:

- \$6.92 million to Colombia's Aeronaves Nacionales de Colombia (Avianca) for a \$14-million Boeing 708 order
- \$20 million to Bolivia's Bolivian World Airlines for a \$35.6-million Boeing 707 order
- \$46 million to Air France for a \$113.3-million 707 order
- \$5 million to Garuda Indonesian Airways for a \$9.9-million order for three

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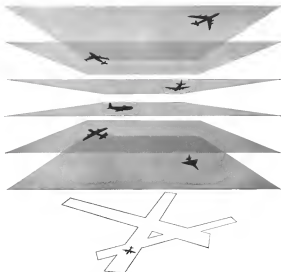
Will be assigned to an intensive structural design group with the opportunity to calculate stresses along with responsibility for lifting test airframe components.

Please send resume for North American Aviation, Inc., 10000 North American Drive, Suite 100, North American Division, 10000 North American Drive, Suite 100, North American Division.



All would be responsible for the development of structural analysis and design, both in aircraft and missiles.

**COLUMBIA DIVISION
NORTH AMERICAN AVIATION**



Cubic MOPTAR—key to jet age collision avoidance



MOPTAR requires only the measure transponder in each participating aircraft.

Using only stationary antennas, with no moving parts, a single Cubic MOPTAR ground station (like the one already in operation) can be expanded to provide 3-dimensional position data on as many as 400 aircraft. The expanded system can provide terminal and accurate surveillance, positive aircraft identification, conflict prediction, and navigation data. To avoid collisions, MOPTAR space-time information would be automatically and continuously processed, and potential conflict data transmitted to the aircraft involved. MOPTAR, combining Cubic position DME (Distance Measuring Equipment) and AME (Angle Measuring Equipment), was developed for the United States Air Force and the Federal Aviation Agency. For more information, write Dept. AW-105, Cubic Corporation, San Diego 11, California.

EMPLOYMENT OPPORTUNITIES—Many challenging Space Age projects at Cubic invite inquiries from experienced engineers and scientists.



WHO'S WHERE

(Continued from page 25)

Honors and Elections

Donald J. Leach, vice president of Ford Motor Co.'s Defense Products Group and general manager of the company's Automotive Division, has been named Southwestern Regional Vice President for the National Science Foundation.

Dr. Donald E. Mikes of North American Aviation's Space and Information Systems Division has received the Society of Automotive Engineers' March National Award for promoting 1968's best paper on vehicle suspension design policies.

Col. Carlos H. Whitfield, director of Time Coordination for the Corps of Engineers Military Construction Office, Los Angeles, Calif., has been named the recipient of the Society of American Military Engineers' Whitaker Medal for his "supervision and administration of construction of coastal defense installations."

Changes

Dr. Vincent Bonetti, technical assistant to the director (Washington, D. C.), Aero Space Corp., Los Angeles, Calif.

Charles R. Kneale, chief systems program planning department, Weapons Center of Northrop's Military Electronics Division, Scottsdale, Ariz.

Henry M. Stewart, director of marketing, Aero Systems, Inc., Tulsa, Okla., N. Y.

Robert G. Dow, manager of the north central service systems group, Goodyear Aerospace Inc., Marietta, N. Y.

Arthur B. Wellman, engineering project manager, Data Systems Operations, Systems Planning Products, Inc., Norwalk, Conn.

D. W. Kneale, project manager, Systems Engineering, Division, Goodyear Aerospace Corp., Tulsa, Okla.

Dr. Charles F. Black has joined the technical services staff of the Boeing Defense Corp., Los Angeles, Calif.

Shurt M. Humes, assistant ground systems for operations, Electro-Optical Data Systems, Inc., Pasadena, Calif.

Thomas N. Kneale, general manager, General Research & Testing Laboratories, Glendale, Calif., a division of Idaho Motor Industries, Inc.

Robert D. Leach, marketing manager, Aerospace and Defense Sales Division of Raytheon Co., Lexington, Mass., succeeded George G. Trotter, who left to accept a newly created corporate post of consultant, security components.

Robert L. McClellan, management consultant, General Dynamics-Corporation, Military Products Division, Rochester, N. Y.

Paul Carl Olson still oversees local electronic communications, Aero-Glo Audio Corp., Alexandria, Va.

John S. Liao, special assistant to the head of the National Research and Development Division of Aero-Concept Corp., Ames, Calif.

Oliver Boylan and **James Folsom** were named after specialists, Corbin Aircraft Co., Wichita, Kan.

Malcolm C. Tucker, Eastern regional manager (Washington, D. C.) for Telecommuting Corp., Los Angeles, Calif.

ELECTRONIC SYSTEMS CAPABILITY

The Columbus Division of North American Aviation offers unlimited opportunities to Electronic Systems Engineers to contribute to advanced technology and to forward their careers. These engineers will assume responsibility for the development of electronic equipment for advanced weapon systems.

To qualify, a background in one or more of the following fields is required:

- Data Processing and Handling
- Design of Electronic Computers
- Design of Electronic Packaging (Universal)
- Design of Logic Digital Computers
- Design and Development of Thermoacoustic Circuits
- Development and Design of Antennas
- (Airborne and Ground Based)
- Development of Microwave Systems
- Analog and Digital Programming
- Ground Communication and Surveillance Systems
- Operations Research
- Radar Systems Design
- Reconnaissance Systems
- Reliability
- Remote Automatic Electronic Test Equipment
- Surveillance Systems
- Solid State Devices
- Systems Analysis
- Radar Control
- VHF-UHF Antenna Development

Please send resume to: North American Aviation, The Professional & Technical Employment Office, Box 49-215, 4300 East Fifth Avenue, Columbus 13, Ohio, Attn: Mr. Gordon Holt.

All qualified engineers will receive notice and in the workplace without regard to race, color, sex, or national origin.

COLUMBUS DIVISION

NORTH AMERICAN AVIATION



Work better,
live better
in the uncongested
Pacific Northwest.

Each model of 727 development shows working under construction.

New 727, one of many programs offering rewarding futures for STRUCTURAL, MECHANICAL AND AERONAUTICAL ENGINEERS

The newly-announced Boeing 727 is a short to medium range three-engine jetliner. In the longer transportation in the history of transportation, Eastern and United airlines ordered eighty 727s. So far, Lufthansa has ordered 12. Deliveries begin late in 1963.

The expanding 727 program at Boeing, along with 707, 730 and numerous transport programs, have created openings for structural, mechanical and aeronautical engineers. Although no craft experience is desirable, training assignments are available, as a selection

test, to graduate engineers in other fields who wish to apply their capabilities to aircraft projects.

At Boeing you'll be working with the world leader in the field of aircraft development. You'll be backed by unparalleled research facilities, including the largest, most advanced wind tunnel installation in private industry. You'll be working in a dynamic career environment that's conducive to rapid advancement.

The Boeing Transport Division is located in the uncongested Pacific Northwest, noted for mild year-round climate,

excellent schools and housing, and beautiful outdoor Western living for the whole family.

MAIL COUPON TODAY

Mr. Jim Phillips, Transport Division, Boeing Aircraft Company, P.O. Box 177, 1722 Boeing Way, Everett, Wash.

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AVIATION WEEK, MAY 6, 1961

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Creative "Birdwatching" at AVCO/RAD

Skilled designers of re-entry data capture the framework for substantial advances in military's state-of-the-art.

At Avco/RAD, where scientists (Creative Artists, Technicians and Mathematicians) plan studies in Apollo, Saturn and reentry vehicles, knowledge in mathematics and physics are applied (RAD) and not judgment to probe orbital and reentry dynamics under actual space test security conditions.

Qualified scientists and engineers are desired to add resources to Mr. J. E. Byrne, Employment Supervisor, Dept. 40

All qualified applicants will be considered regardless of race, sex, color or national origin.

AVCO
Avco/RAD
A Division of Avco Corporation
291 Lewis St., Wilmington, Mass.

Journal Watch presents the opinions

I have read and noted your editorial in 1 JULY 1982 issue of *ANATOMY WEEK*. I sincerely hope and wish that more men who have in wide domains regarding the participation of women will have the opportunity of reading your editorial as I believe that it has more thoughts to offer to mankind at times at the points that were brought out in your editorial. I would like to mention a few facts:

[illegible]

2. We find that we are working in good or new and better agreement, but our problem is not studied by the historical people of the United States because our problems are not similar or applicable with regards to the domestic problems in the United States. We therefore, have found that as-
 spite of ourselves, we need look to other
 ways for possible solutions to our aviation
 problems.

5. The transmission of the bilateral agreement between the United States and the Philippines is further indication of the apparent cleavage that is being created between the United States and Philippine nations. I therefore, humbly realize your serious conviction that there be a reevaluation of the United States program.

We in the Philippines believe that there is an immense reservoir of goodwill toward the United States, especially in the southern field. We do feel, however, that we must get the United States to see and recognize our problems with the view to arriving at solutions that will be of mutual benefit to both countries.

Our interviewees at the Philippine U.S. bilateral industries that the first bilateral signed in 1947 was acceptable to the Philippine side at the time when the U.S. was in a position to offer the Philippines a political and financial partnership that would have put the Philippines on a par with other nations that had just acquired an independence. Over the years the Philippines has developed its own company, and felt that the original bilateral was too one-sided and as Philippine national identification grew, we felt that the original bilateral was not a good agreement should be amended. Naturally, with a bilateral would have dominated at shortages were equally not therefore, a solid result on a bilateral was needed. This has resulted in us to support which seems unnecessary, considering the actual and real situation, but because the United States is the Philippines.

American Fork welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, *American Fork*, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 300 words and give a positive identification. We will not print anonymous letters, and names of writers will be withheld on request.

If we are going to be successful this time, friends that we are, it is our considered opinion that America must understand our point of view, that we must be treated no less than those who were crushed and who have already become friends. We are resolved in our feelings and conviction that we are friends, that we have been friends and will also be friends.

I can, have, depressed from the point which I originally intended to write to you about, and that is I cannot fully share the thin edge of this, a edge is an actual and not a straw one that wants thought and action for if the law nations do not take seriously of their established goods if then the South can do so and do so at their own full advantage.

Reserve List
Vice President
Philippine Air Lines
Manila, Philippines

The article entitled "Beating Nevada Final 717 Design Details" by Wilkins & Reed (NW Mar. 6, p. 60), carefully explains why some of the features of the Victor VC-10 and General Electric were considered and rejected.

However, no comment was made of the de Smetland D44 211. This would have been a most interesting comparison since, superficially at least, the proposed T27 seems to be merely a slightly enlarged version of the D44 212.

Curve 8 Lignite
Monsieur, Verc., Cold

Relevance your case of Apr 17 (p 140)
In the interest of contributing to the

Another source of interference may be human, may I add have suggested and phoned I am to see the houses and furnish representations of the USC Air Force command of ground support for the Army. Such keen perception of the Army's need reflects the usual high standards our brethren in light blue strive to maintain in order to ensure that we get the best—even before SAC. I am surprised, though, that the Air Force solicited their guide to the extent that they are willing to suggest French accents and admit that ARDC could not come up with something just as good after trying since 1917.

Vice TAC and Rep Van Winkle
 (Name withheld by request)
 ASSET FORTY-SEVEN WARRIOR
 Washington, D. C.

The Kevins through us open points out a fact that becomes more obvious all the time: America is no longer the land of "free."

Until Dec. 4, 1957, the view of manna was everywhere more fixed on America as the technological leader of the world. This came Sputnik I, which fired the imagination of men as nothing had since the Wright brothers. The world then looked to Russia as the new leader in technology. Its rapid successes came repeated Russian "firsts": a solo satellite, a lunar impact, a reconnaissance satellite which photographed its unknown far side of the moon, manna shot directly acrossed from what a piggyback launch of a Venus probe, and on Apr. 12 1961 the first astronauts of all crossed orbit Earth.

Without doubt, the Kordis deliberately has selected you as the one to demonstrate to the world the technological leadership of Soviet society.

Spain is the area of high adventure and wandering that Shells sees today as Miami Falls, Colorado, and Leadville died was yesterday.

America has been first in war, first in peace, first in political, economic and social leadership, and first in the hopes and needs of men for almost two centuries. Now, because of carefully planned and fully explored triumphs by Russia in space, America is a leader second in the eyes of the conscious men of the world.

We must realize that there is a technological war in addition to the cold war. The nation whose accomplishments demonstrate technological leadership is looked up

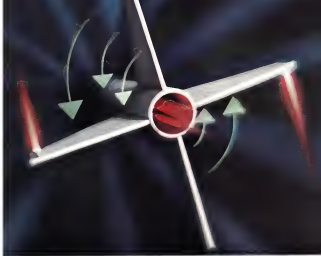
by its Atlantic, Arctic, European and South American. America may be first in wage scales, living standards, life span, education, medical research, entertainment, leisure time and shopping centers, but there means nothing to billions of people whose cultures are so very different ours. These billions can grasp the reality of age, old dreams of soaring in space and exploring the moon and planets.

These achievements are tangible to all men. The action to achieve them leads the world of all men.

We can look forward almost inevitably to the next truly predictable Rascals from a multi-man orbiting vehicle, a manned space station, manned flight around the moon, a manned landing on the moon, a manned lunar colony, and manned exploration of the planets. In addition to these space adventures, Rascals almost certainly will be years ahead of us in producing a nuclear-powered aircraft and a Mach 5 commercial jetliner.

Must America continue to be second? Must America, by lack of imagination and drive, deliver by default the mouth of men to the Karaoke? Are we susceptible of shaking off our complacent lethargy and using our funds and know-how on a concerted long range basis to establish our fine tradition of being first?

Calvin C. Campbell, M. D.
San Antonio, Tex.



Downloaded from <http://ajphaphysiol.physiology.org/> at N. Ford, on September 12, 2012

Conventional aircraft control surfaces will not push

Conventional aircraft control surfaces will not guide space ships and capsules. Rudders, ailerons and elevators find no resistance and hence produce no reaction to their movements where there is no atmosphere. Even at altitudes only half way up, they are doubtfully ineffective.

The accepted answer to a dependable steering mechanism for astronauts is a system of jet reaction control developed and produced by Bell Aerosystems Company. First used on Bell's own supersonic X-1B several years ago, the system has been greatly improved and adopted for the X-15; the Mercury man-in-space program and other space vehicles.

Through strategically located low and high thrust (± 1)

1500-horsepower rocket engines. Ball's reaction controls not only position and guide the ship by controlling the roll, pitch and yaw, but they also provide for orbit changes and retro-thrust. Some of the jets are throttleable while others can be operated in combination to provide the astronaut positive and flexible control.

This revolutionary steering gear for space, available using monopropellants or high energy bipropellants, is just one of many advanced projects which are currently engaging the diversified talents of Bell Aerospace Company in the fields of rocketry, aerospace and space techniques. Engineers and scientists seeking challenging, long-range career opportunities can find them at Bell.

PHANTOM II: *The airplane with a dual role in defense planning—Air Defense and Air-to-Ground Attack*

The Phantom II teams two men with two engines to perform two missions at more than double-sonic speed. Simply changing the armament fits the Phantom II to the combat situation in minutes in any kind of weather, day or night.

Sparrow III missiles and a host of other air-to-air and air-to-ground weapons, both conventional and nuclear, are carried for complete versatility.

The two man crew concept of the McDonnell Phantom II makes full use of human reliability and judgment. Crew skills are substituted for electronic complexity and combined with advanced radar, fire control, instrumentation and communication systems for total efficiency in mission performance.

Twin J79 engines with afterburners combine safety and outstanding performance. The Phantom II has reached an altitude of 98,560 feet, holds world closed-course speed records for both 100 and 500 kilometers and has a dash speed in excess of 1500 mph.

The combination of speed, extended range, weapon carrying capability and a dual purpose all-weather radar system uniquely qualifies the Phantom II for its counter-force role and means maximum defense for every defense dollar.

Reprints available: "Common Sense
Talk About Reliability." McDonnell's
Interdivisional Reliability Mgr. de-
fines Reliability in layman terms.
Write: Dept. 80RB, McDonnell
Aircraft, St. Louis 66, Missouri.

MCDONNELL

*Phantom II and F-101 Fighter and Attack Aircraft •
Project Mercury and Aeroballistic Spacecraft • Talos Airframes and Propulsion Systems •
Quail Decoy Missiles • Rotorcraft • Electronics Systems • Automation*

MCDONNELL AIRCRAFT • ST. LOUIS



powered by two General Electric J79 engines
with afterburners • long range combined with
unmatched dash speed • adaptable to conven-
tional or nuclear armament • exceptionally short
field-length requirements • dual flight controls for
use as its own trainer • in full-scale production